"DYNAMIC LAB" VS. "STATIC LAB" PROMISES PROFITABILITY FOR PAPERMAKERS

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A DYNAMIC PROCESS, SUCH AS PAPERMAKING, NEEDS DYNAMIC, NOT STATIC, LAB TOOLS TO MAINTAIN PRECISION.

WHAT IF YOU COULD RAISE QUALITY TO A HIGHER standard and even adjust specifications while making paper?

- What if you could increase the price to your customer because quality control tools have assured higher performance at their facility?
- What if you could virtually eliminate customer complaints on quality?
- What if you could increase profitability by US$ 2–5 per ton while paying off the investment in less than one year?

All of these accomplishments are happening as papermakers turn increasingly to the dynamic lab philosophy to allow for tactical process adjustments in real time and strategic fine-tuning for the long term. By contrast, the dynamic lab is the antithesis of the traditional lab that simply tests the paper long after it has been produced. The dynamic lab is based on the premise that a dynamic process, such as papermaking, needs tools to maintain precision. The fallacy in today's papermaking process is to only use the lab for final measurements, as shown in **Fig. 1**. At that point, it is too late. The promise of the dynamic lab is to use the information to improve papermaking.

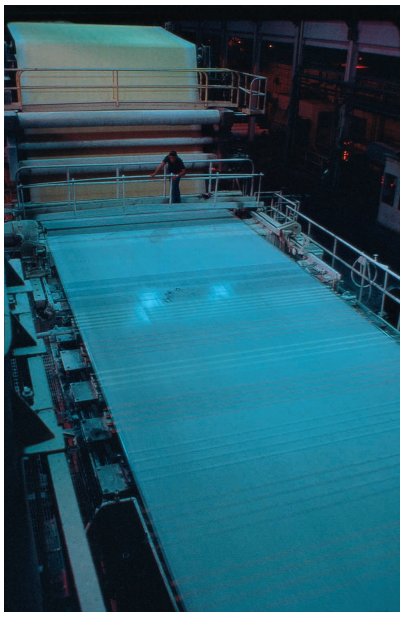
1. Sometimes a lab may only be used for final measurements, after it is too late to correct problems.

Precision instruments, linked together through automation and connected to process and quality control, are allowing for a revolution in the very concept of the lab, redefining it as a productivity and profitability tool. Using an array of technologies, from stand-alone testing equipment to fully automated systems, a quality control lab will look more like an extension of the paper machine than a remote lab.

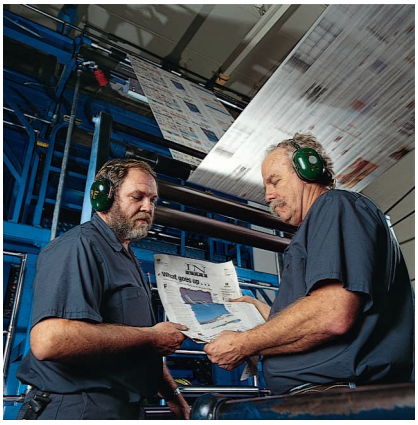
If this sounds like a page out of a presentation from a process control supplier, it is—with a new twist. The new emphasis is on communication and empowerment, because the sooner we see paper testing integrated into the papermaking process, as illustrated in **Fig. 2**, the sooner we can profit from it. Information, no matter how good, if not acted upon is static and therefore virtually worthless. However, if the information is acted upon, it becomes dynamic, and if used properly, it becomes a powerful tool for optimization.

The longer the gap of time between lab results and the papermaker, the larger is the lost opportunity to produce a superior product. This is the major problem with the way lab data is used today. With end users putting papermakers to the test when it comes to the quality of their product, yet another reason for a dynamic lab comes into play.

Simply stated, the strategy to elevate the lab to an integral part of the quality control process opens the way for better papermaking at lower overall costs. Where do we begin? A little detective work is a good place to start. For example, let's think of problems faced at a newspaper pressroom and a box plant, then work back to the dynamic lab at the paper machine. This is the only way to ensure satisfaction of the final customers—the news-



2. Aerial view of the forming table



3. A running newsprint press

paper reader and the package consumer.

NEWSPAPER PRESSROOMS

At the breakneck speed of a newspaper pressroom, shown in **Fig. 3**, with hundreds of multisection newspapers being printed and folded every minute, the last thing anyone wants is a web break. Often the cause is the newsprint quality itself. Quality issues such as poor strength can result in huge losses. They can always be traced back to the papermaking process. These problems can be avoided if the paper itself is produced more tightly to quality standards.

Problems such as baggy edges, misregistering, and roll hardness can also be detected and corrected. **Figure 4** illustrates the offset printing process.

BOX PLANTS

Flatness in linerboard and corrugated fiberboard is extremely important. Nonflatness (curl, twist, or warp) is caused by differences in hygroexpansivity, as well as other reasons, and is a serious quality problem. Testing equipment is now available to help spot these problems, enabling papermakers to make changes to the process.

TESTING MEASUREMENTS LEAD THE WAY TO QUALITY

Regardless of the paper grades you make, precision testing equipment can do the job faster and more accurately than presently performed, freeing personnel to problem solve and fine-tune the process. This in itself can save money. For example, by eliminating just 30 minutes of job lot, thousands of dollars can be saved per occurrence.

There are several benefits to using the information from your lab for quality control and process optimization.

- **More test results**. Quality control testing must be done on every reel, as shown in Fig. 5, in order to maintain a true sense of the process. Frequent testing will verify that each reel remains in spec.
- **Immediate test results**. The prompt feedback of data to process control is critical so that adjustments can be made to immediately improve the process. Instruments that rapidly generate test data are available to empower the papermakers to optimize their machine.
- **Improved testing accuracy**. By using standardized instruments, all tests are done in the same manner, as shown in Fig. 6, independent of operator or shift. The operator simply inserts the sample and starts the test. Statistical data are therefore accurate, reliable, and repeatable.
- **Improved customer satisfaction**. Meeting your customer's specification is critical for the obvious reason of customer satisfaction. But how can papermakers be sure their instruments and results are accurate? This is why standards and the instruments that test according to these standards are so important. They supply the industry with traceable testing procedures that ensure consistency in testing. These procedures reduce operator influence. Only now can your customer be sure that the test results are accurate and repeatable, with their specifications met.

INFORMATION FLOW IS THE KEY TO THE DYNAMIC LAB

The essential question, of course, is how to put the lab data to work in real time. Today's communication technologies greatly simplify the task of connecting different devices. The Ethernet-based Plant Information Network (PIN) has become a mill de facto standard. Connecting the lab information from either an automated system or stand-alone instruments is straightforward. Once implemented, all information is available to those who need it to make real-time decisions.

When the PIN expands to include the gauging system, distributed control system, web inspection system, and even pulp mill data, a full view of the machine is mapped. This empowers the operators, engineers, and management to optimize the process and ensure end-user specifications are met.

4. Offset printing process

OPTIMIZING THE PAPER MACHINE

Optimizing the paper machine can be an elusive process. Without the proper measurements, it simply cannot be done.

Many new measurements have been introduced recently, such as fracture toughness, felt permeability, and tensile stiffness orientation (TSO). These augment the old standards of caliper, gloss, smoothness, burst, tear, STFI, porosity, and many others. It is only by performing these tests on every reel and providing this information to the operator that the machine can be optimized. The key is to use the customer specification for control. Why waste hundreds of thousands of dollars per year by shipping heavy product just to ensure strength?

LAB STATUS RISING

The benefits of the dynamic lab are obvious to any papermaker seeking to continuously upgrade quality, better understand the process, and be more productive and cost efficient. The more the industry shifts the function of the lab onto the mill floor, the sooner the passive image of the lab will finally go away.

TJ

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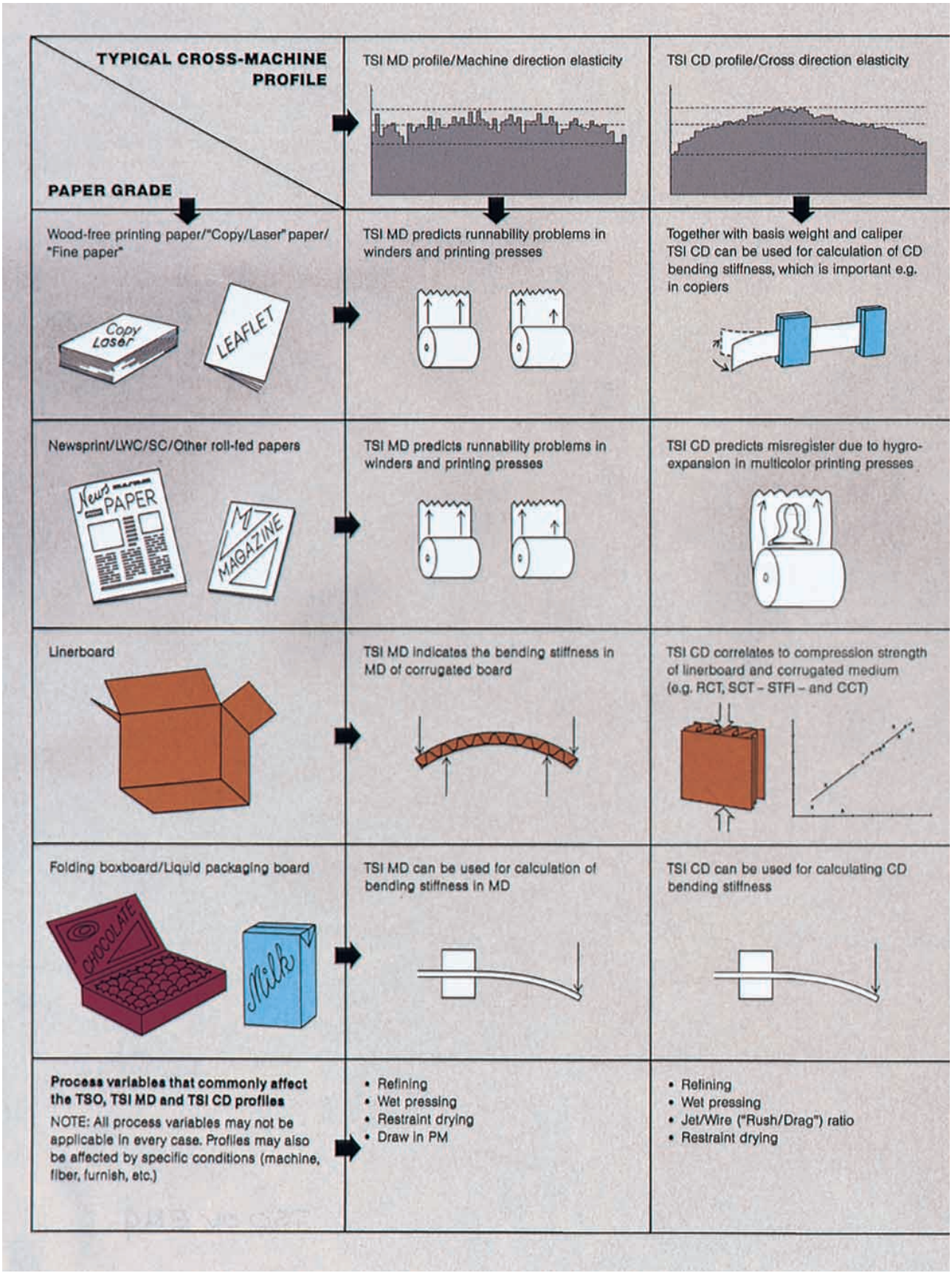
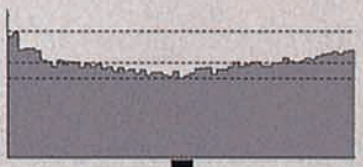
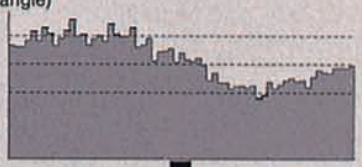
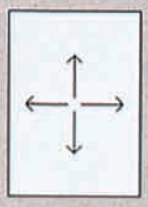
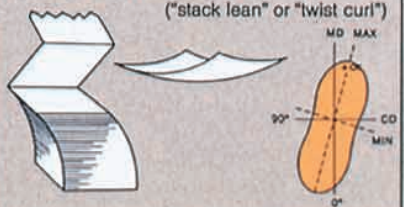
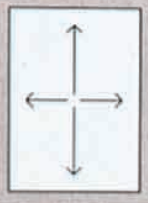
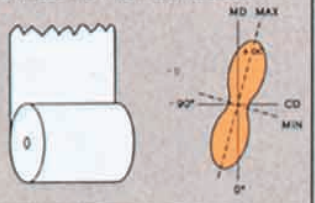
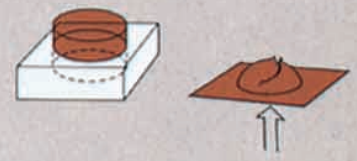
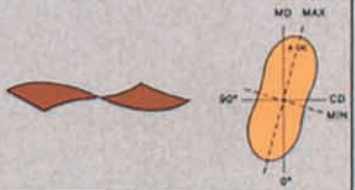
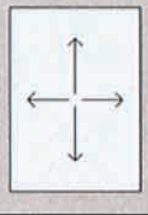
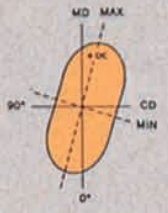
5. Manual inspection of the roll

6. Standardized instruments permit all tests to be done in the same manner.



7. Possible adjustments to a paper machine using tensile stiffness orientation numbers

TSI MD/CD ratio profile	TSO angle profile (Often referred to as polar angle)	**Typical uses of results among TSO equipment owners**
		
TSI MD/CD ratio predicts runnability in conversion processes for both rolls and sheets 	A TSO angle outside ±3 degrees indicates a greater risk of dimensional stability problems ("stack lean" or "twist curl") 	• Prediction of Twist/Curl • Prediction of runnability in conversion processes • Prediction of dimensional stability
TSI MD/CD ratio predicts runnability in conversion processes for both rolls and sheets 	A TSO angle outside ±5 degrees indicates runnability problems in printing presses 	• Prediction of baggy edges and wrinkles • Prediction of misregister in multicolor printing presses due to different hygroexpansion MD/CD
TSI MD/CD ratio is a good indicator for optimizing compression strength vs. bursting strength 	A TSO angle outside ±5 degrees indicates a greater risk of dimensional stability problems in corrugated board ("twist warp") 	• Prediction of Twist/Warp • Prediction of compression strength through correlation of TSI CD and Compression strength
TSI MD/CD ratio can be used for optimization of PM on bending stiffness MD/CD ratio 	A TSO angle outside ±5 degrees indicates that the headbox is out of tune! 	• Optimization of bending stiffness in MD and CD through the connection between TSI/Bending stiffness
• Jet/Wire ("Rush/Drag") ratio • Draw in PM	• Jet/Wire ("Rush/Drag") ratio • Headbox pressure profile • Slice opening profile • Forming table • Dewatering	

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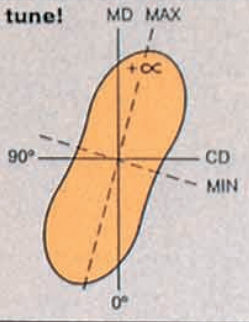

Two examples of equipment that provide lab information to optimize the paper machine are tensile stiffness orientation (TSO) measurement and the Scanpro line.

TENSILE STIFFNESS ORIENTATION (TSO) INFORMATION

The TSO features automatic measurement of the complete in-plane range of elasticity properties of an entire cross-machine sample strip. A TSO instrument lets the user analyze the performance of the headbox, press section, or dryer section, and in so doing ultimately predict the final runnability of the product as well. The TSO can be used to predict runnability problems of various kinds, such as "twist-curl" in copy paper, "stack-lean" in continuous forms, or "baggy edges" in newsprint.

Figure 7 provides a summary of some of the ways to adjust a paper machine by using the TSO numbers.

SCANPRO INFORMATION

After the headbox is balanced, utilizing the TSO measurement, the next step is to look at the press section. Two tools for monitoring the press section are the Scanpro PressTuner and the Scanpro FeltPerm. These tools can help to determine if the crowning of the press rolls is adequate, if the felts are in good condition, if the felt cleaning system is working, if the suction boxes are operating properly, and, of course, if the press section is properly adjusted. **Figure 8** shows how the FeltPerm graphs water permeability of the felt.

These tools enable users to know moisture content at all stages of production, which is critical. These hand-held "lab" instruments immediately provide test results that used to take hours, if they were done at all. No matter what grade or weight, cross-direction moisture profiling and machine-direction moisture measurement can be done on the spot.

8. Tool to monitor water permeability of the felt