



*Green Bay Packaging, located along the banks of the Arkansas River in Morrilton, Arkansas, has two linerboard machines that produce corrugating medium and linerboard grades ranging from 26 lbs to 69 lbs.*

## **Major Breakthroughs in Control of the Forming Section Set a New Pace at Green Bay's Morrilton Mill**

### **Documented Proof of the Impact of Fourdrinier Table Control on Basis Weight, Strength and Speed on Linerboard**

By Mike Pruitt

It is obvious that sheet properties are built in the forming section, but there is a bit more to it than this simple thought implies—as every papermaker certainly knows.

This is the story of one papermaking teams' challenges—and ultimate success—in achieving their goals of the highest strength properties (mullen, ring crush, STFI) with the lowest basis weight on demanding kraft linerboard grades; all with significant increases in speed. This major accomplishment was made possible as a result of several important breakthroughs in the control of stock activity and drainage along the entire sheet-forming zone of the fourdrinier table.

(Green Bay Packaging in Morrilton, Arkansas has two linerboard machines that produce corrugating medium and linerboard grades ranging from 26 lbs to 69 lbs. Here, the focus is on the Fourdrinier of Papermachine Number One, which typically produces grades ranging from 33 lbs to 69 lbs.)

## **“We Had a Forming Problem”**

William Cone, Operations Manager, summed up the challenge, “We had a forming problem, but we were not going to ‘jump off the cliff’ and spend 20 million dollars on a gap-former or something of that order. We knew, full well, that we could make excellent product using today’s advanced Fourdrinier technologies in combination with current papermaking know-how.”

“We began by installing a new headbox. However, we were unable to run the headbox to its full potential. We simply did not have enough drainage capacity on the table and that limited the headbox flow rates and consistencies that we could achieve,” added Doug Latimer, the mill’s Project Engineer. “So, we started talking to some of the industry’s drainage experts to learn which organization might be best equipped to help us optimize our Fourdrinier table. We looked at the specific products offered by various suppliers and we looked at the experience each could bring to the table (no pun intended). After careful examination, we chose the IBS Paper Performance Group, frankly, as much for their expertise as we did for their technologies—and we were impressed by their technologies.”

“Early on, Jim Faufau and Andy Forester from the IBS Paper Performance Group shared important proprietary information about the key dynamics of drainage optimization with our mill team. We found their insight into the full range of process components to be particularly enlightening. In addition to the powerful theoretical information they shared with us—we were impressed with Jim’s and Andy’s practical way of conveying this information, to our team,” Lonnie Flowers explained. “They are especially good at communicating at the operator level. Everyone was well informed and was able to take an active part in the effort.”

## **The First Step To Reaching An Ambitious Goal—A Comprehensive Wet End Study**

The process began with an analytical wet end analysis called a Wet End Optimization Study (WEOS) conducted by the IBS Group. This comprehensive survey, which included extensive detail relative to the behavior of the headbox and every table element, was completed in late February 2006. The results from this study defined the possible results with an optimized version of their table.



*The addition of six table elements, and other proprietary operational changes, have increased the speed of the number one papermachine by 100 feet per minute.*

In essence, the study demonstrated that the addition of six new drainage elements could provide dramatically improved stock activity and drainage control to increase strength properties and reduce basis weight. According to the mill team, it was clearly the best approach.

Beyond improved formation, the secret to improving strength—according to IBS—is controlled micro-turbulence and drainage during the sheet forming process.

Andy Forester of IBS explains it this way, “With a high-frequency table design, more micro-turbulence is created which generates more localized shear. Increasing the amount of shear prevents the fibers from floccing and keeps them mobilized in the stock suspension. Once the fibers are free to move, adjustments to the headbox can be made along with adjustments to the table drainage profile to promote machine or cross-machine direction alignment of the fibers throughout all of the layers of the sheet. This has a significant impact on sheet strength properties such as mullen and ring crush.”

The major factor involved here is the ability to control stock activity and drainage along the entire sheet-forming zone of the Fourdrinier table. Up until recently, this technology and approach was simply not available. Although adjustable dewatering units have been on the market for a while, most of them have been located directly after the forming board. This allows only a brief window of opportunity to modify the fiber orientation. The focus in this case, however, is to provide control from the headbox to the end of the sheet-forming zone, where fiber mobility has almost ceased.



*The days of having to rein in the capabilities of the new headbox are over at Green Bay, Morrilton shown here producing a 69 lb grade.*

This is a particularly notable advancement since—on linerboard grades—each different basis weight focuses either on “mullen” (machine direction property) or “ring crush” (cross-machine direction property). Equipped with “full-length” adjustability—from the headbox to the point where fiber mobility has almost ceased in the forming zone—the specific properties of each grade can be optimized. Prior to this advancement, the papermaker only had control of the headbox jet/wire differential to accomplish this feat. Now, the papermaker, equipped with added capabilities, has control of the table also; making this an important step in papermaking evolution.

## **Step Two—Proper Implementation**

New table elements were fabricated by the IBS Paper Performance Group and included proprietary drainage technologies such as: the IBS Hydroline™ Plus, with both angle and height adjustable t-bars and foils; and the IBS Varioline™ Plus, with height adjustable t-bars and control blades. These elements were combined with the IBS EVA™ (Electronic Vacuum Control System), which provides precision vacuum control, as well as providing the capability of being able to “dial in” a specific vacuum recipe for individual grades. (This capability is essential for quick grade changes, which are important to the product production needs of Green Bay Packaging.)

Doug Latimer explained the installation process this way, “It went according to our schedule,” and laughed as he explained that there had been operating issues at the mill that required several adjustments to the schedule. “Basically, we had to make adjustments to the

schedule because of one reason 'ORDERS', and that's a good thing! Seriously, IBS worked very well with us; adjusting their schedules as our schedules adjusted. Initially, we had planned to install in September of 2007—we installed the equipment in January 2008.”

### **Step Three, Start-Up—Experiencing The Power Of Advanced Adjustability Throughout The Forming Zone**

Prior to start-up, IBS provided individual training sessions for every crew.

“We did off-site presentations related to theory and to the specific technologies in use on the table. Then, once everyone was trained, we went out on the machine and worked with each crew as we went through the start-up trials,” explained Andy Forester. “Frankly, I think everyone was a little bit afraid to see the machine go so fast.”

Jim Faufau added, “Start-up was smooth and easy and I think there was some surprise among the crews regarding how quickly the new equipment achieved the strengths and basis weights promised. The dry-line was straight and in the optimum location. The days of having to rein in the capabilities of the new headbox were over at Green Bay Packaging, Morrilton.”

### **Step Four—Make More And Better Paper, Everyday**

“I don't want to get specific but when you reduce the basis weight and also raise the speed up, I'd say, over 100 feet per minute and still meet test, that's an accomplishment,” Gary Howell, #1 Machine Manager admitted.

“As mentioned earlier, our main objective was to reduce basis weight on the 35 lb high performance grade and we definitely have seen an improvement—we reduced the basis weight by 2 lbs on this grade,” reported Gary Howell.



*“We reduced basis weight on 35 lb by 2 lbs, increased CD strength, and increased speed,” explained Gary Howell.*

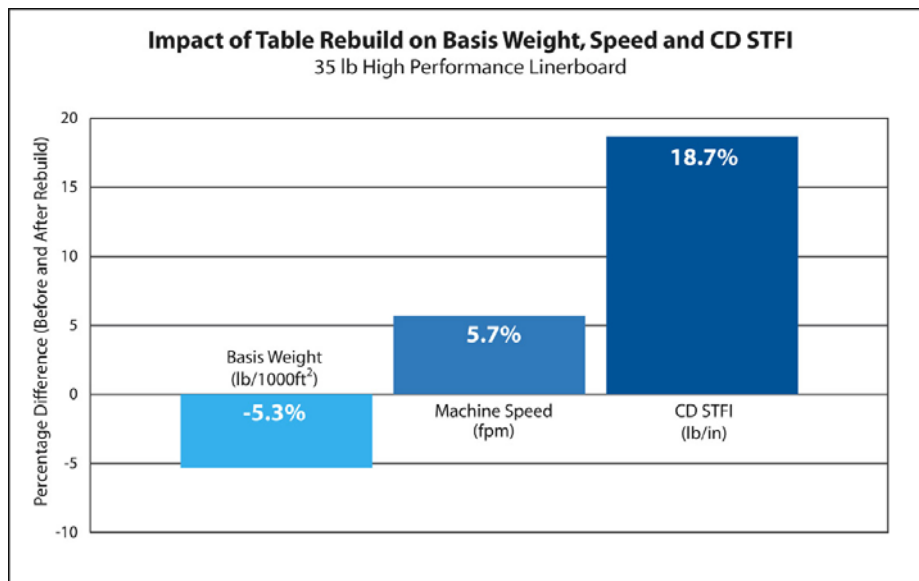
“The table is no longer the limiting factor, there are other limiting factors,” said Doug Latimer. However, I’m pleased to say, we haven’t seen the limits of the table, yet.

Then Doug Latimer continued, “It’s simple, we started to get a payback by the end of the first week. As a Project Manager, there are very few projects where you see immediate results—but this is one of them. GOOD PROJECT!”

### You Can Optimize By Grade and Pre-Set Your Recipe

Lonnie Flowers added, “Before, we were fully manual—what you had, was what you had. But, being able to adjust the vacuum and control the table to work with you through speed and grade changes; I don’t think we can quantify how much that’s worth.”

Lonnie continued, “I think that this is one of the unique characteristics of this technology. You can optimize by grade and it’s relatively easy to go out there and set the boxes and pre-set your recipe when you make a grade change. You can do it in five minutes. With some systems it’s just set, you got what you got. It has a sweet spot; just one set-up. In actuality, each grade has it’s own sweet spot. Once you dial in that grade—and that was a big part of what they did for us at start-up, was to optimize each grade independently—then you capture that recipe. After the IBS guys leave, you’ve got those settings, so when the operators make the grade changes, they go out there and they set the elements in the positions that they need to be.”



Comparison showing the percentage difference in basis weight, machine speed and CD STFI after the fourdrinier table rebuild.

## Now, It's A More Forgiving Papermachine

“Before, when you would get stock changes, our only real option was to slow back because of the limitations of the table. Now, with the optimized table, we can kind of “weather” some of those storms. For example, before when we tried to increase the usage of OCC—in the past— we got too wet on the table. There was a limit to the amount of OCC we could put in because of drainage conditions on the table. Of course, OCC dries well after you get it through the press to the dryer. But with this table and its increased dewatering capacity, we are able to utilize more OCC—with good test and formation, even with the OCC percent up. We are consistently able to maintain tests, and increase production capacity,” explained Lonnie Flower.

## Ultimately, The Answer Is Brainpower Plus Hardware

“The IBS Group—and particularly Jim Faufau and Andy Forester—have proven to us that they really know how to make a Fourdrinier table work. But also, and maybe just as importantly, they have shown all of us that they understand a papermachine well enough to bring some other insights into how to improve the performance of many aspects of our paper machine. It's just not hardware; it's brainpower plus hardware. It's cumulative,” says Lonnie Flowers.



*Green Bay Packaging Project Team at the wet end of the paper machine.  
(Pictured left to right: Jim Faufau, William Cone, Andy Forester and Gary Howell).*

**About the Author:** Mike Pruitt heads the consulting and marketing organization of Pruitt Humphress Powers & Munroe, Inc. and has over 25 years of experience in the pulp and paper industry. [mpruitt@phpm.com](mailto:mpruitt@phpm.com).