

# The Fabric of Paper Machine Performance

Innovations in forming fabric technology help paper manufacturers achieve higher performance goals.

By Steve Cole

Forming fabric technology has changed drastically in the past few decades. A quick review of what was once considered state-of-the-art for a particular time period provides clear evidence that the advancements in this PMC segment have paved the way for increased paper machine performance, sheet quality, and competitive manufacturing economics.

As predicted, demands have continued to push for higher machine speeds and ever-improving sheet properties at a time with more challenging furnishes and operating costs.

At Xerium Technologies, (Weavexx and Huyck.Wangner), we too have pushed the research and development engineering groups to meet these demands through continued innovation in forming fabric technology. One example is the magnitude of change in fiber support engineered into our modern triple-layer fabrics.

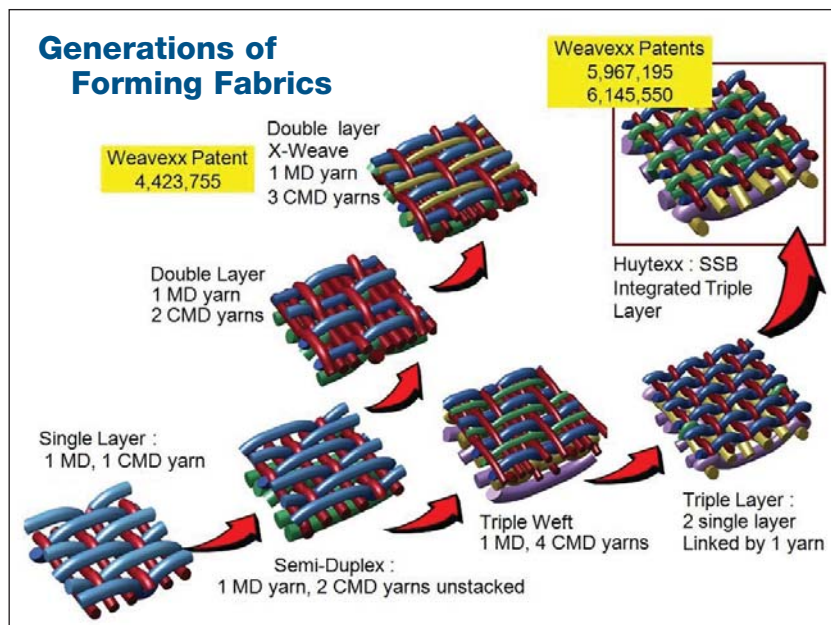
In a span of approximately twenty years, fiber support capability has improved by 40-50 points, or about 25%, for the best-in-class fabrics applied to the most demanding machines and grades. This progression in technology lead to perhaps the most significant advancement ever in multi-layer forming technology in the mid 90's...the world's first SSB (support shute binder) triple layer plain weave fabric we call Huytexx. For the first time papermakers

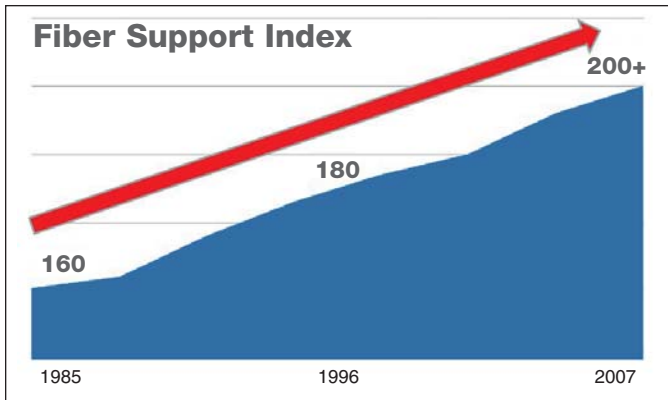
had a "tool" delivering very high fiber support, high drainage capacity, both built on a new foundation of a reverse stitched binder concept that virtually eliminated inter-layer wear. This patented technology quickly became the new global benchmark for high performance machines making newsprint and graphical grades. Huytexx's rapid success led to the introduction of other designs variations of the concept — particularly Synergie, a low caliper higher mesh product, and Titan HTX for packaging grades — both extremely successful and widely applied today.

## A TOTALLY NEW WEAVE CONCEPT

However, the development process required to produce further innovations often demands totally new concepts. In most cases it is difficult to continue the historical practice of building finer fabric structures merely by using smaller diameter yarns with the same weaves at higher mesh counts in the MD

and CMD. Because of the yarn crossover points in the fabric body, as mesh increases so do drainage restrictions for any given weave structure, thus leading to a point of diminishing return on the relationship between increasing fiber support and retaining adequate drainage capacity. The inherent design limitation requires new structural concepts to further extend the





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boundaries of fiber support without restricting drainage.

Since headbox fluid dynamics predominantly delivers fiber from the jet in a machine direction orientation, the ideal forming fabric structure should be strongly CMD oriented to optimize the retention of MD oriented fibers.

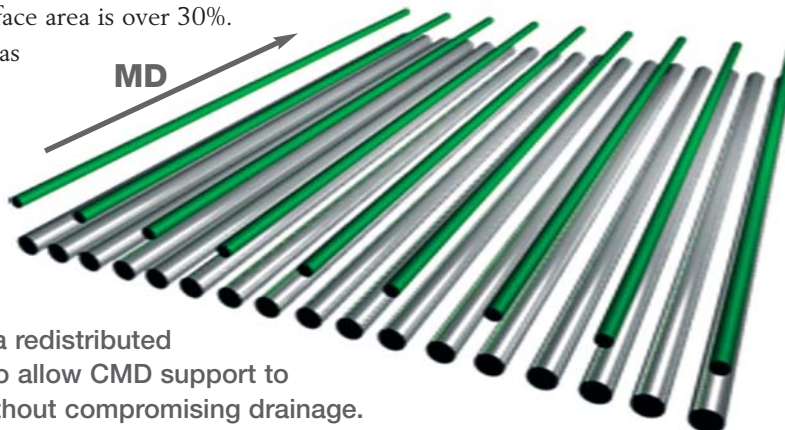
Vortexx, a new weave concept from Weavexx, utilizes a redistributed MD yarn mass to allow CMD support to be increased without compromising drainage, thusly, void volume and fabric caliper are kept low. This creates a totally new structural concept that delivers the highest fiber support values ever reached by a forming fabric, thus improving sheet properties while maintaining drainage.

Vortexx uses two machine side MD yarns for every sheet side MD yarn, thereby creating a more open surface for inserting more CMD yarns. Smaller diameter yarns on the top ensure sheet smoothness and topography while using larger bottom CMD yarns for stability and life. For the same open area, fiber support is increased by 20%. Machine direction yarn mass is transferred to the underside of the fabric where it can increase fabric stability and life potential with no effect on fabric surface openness and drainage.

Because of this redistribution of yarn mass, Vortexx's free surface area is over 30%.

This concept has enabled the 200 FSI barrier to be broken forever. As a result, these fine Vortexx fabric types can

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typically be applied without restricting drainage on machines where drainage rates and couch solids are prime concerns. Vortexx has also proven to stabilize the drainage process, thereby contributing to further improvement in paper quality.

Vortexx has built an impressive reputation on some of the world's most demanding machines. The following are a few examples:

**Optiformer LB.** LWC 48-60 gsm, 1900 mpm, Conveying Position

- 25-30% savings in retention aid
- Excellent sheet forming properties
- Very good profiles
- Higher dry content (+1.5%)

**Bel Baie II.** News 45-52 gsm, 1050 mpm, Conveying Position

- Reduced sheet breaks (from 8 to 4.5 per day)
- Retention aid savings (approx. \$2/ton)

**Optiformer LB.** News 42-48.8 gsm, 1850 mpm, Top Position

- Higher dryness (1.5% higher than SSB)
- Excellent sheet strength
- Lower steam consumption

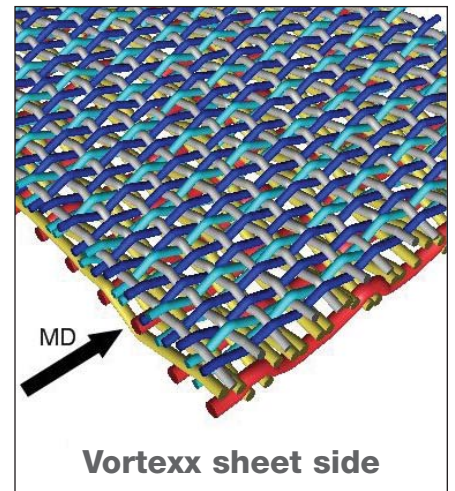
**Symformer.** Improved News 45-55 gsm, 1340 mpm, Bottom Position

- Speed record on heavy weights
- Average breaks reduced 50%
- Couch consistency 1% higher
- Reduced steam consumption

**Speed former HHS.**

SC, SC-A, Improved News 48-65 gsm,

- 1250 mpm, Top & Bottom Positions
- Excellent runnability all grades



- Speed record on 65 gsm (1240 mpm)
- Lower steam consumption
- Best formation ever on machine.

**Optiformer.** SC-A, 38.4 – 48.8 gsm, 1280 mpm, Bottom Position

- Couch solids improvement over 1%.
- Sheet surface properties improved, visual print improved
- Wire mark improved over SSB.

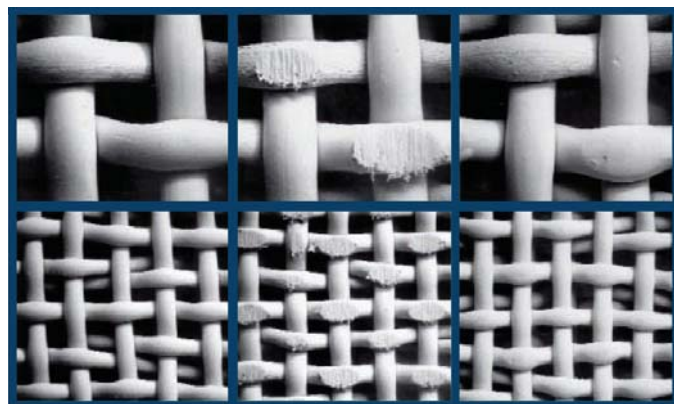
### INCREASING SHEET CONTACT

The paper industry is continually striving to improve paper surface quality. We developed a measurement system to map the paper surface and also accurately and characterize the forming fabric surface. This non-invasive method called WSA uses the latest laser technology to accurately measure the fabrics and paper sheets down to a resolution of 0.001 mm.

WSA allows us to measure the depth at which fiber suspensions penetrate the forming fabric's surface. Thus the cause and effect phenomena between fabric and sheet, such as "true fiber support area," and sheet mark, are accurately analyzed. Early work with WSA looking specifically at wire mark has led to the development of a new process called Compressor. Similar to paper calendaring or press felt finishing techniques, the Compressor process uses precisely controlled heat, pressure, dwell time, and tension control to flatten the knuckles on the fabric surface in a highly controlled manner.

The Compressor forming fabric has increased surface uniformity, higher effective fiber support, lower caliper and void volume. All these improvements are achieved without reducing the amount of material in the fabric, so fabric stability is actually increased. For years fabric makers have "sanded" fabrics for certain applications requiring minimal caliper or special sheet side/machine characteristics. Sanding not only removes mass from the yarn used for wear potential, but can also destroy the integrity of the polymer chain leading to premature failure from abrasion and chemical attack.

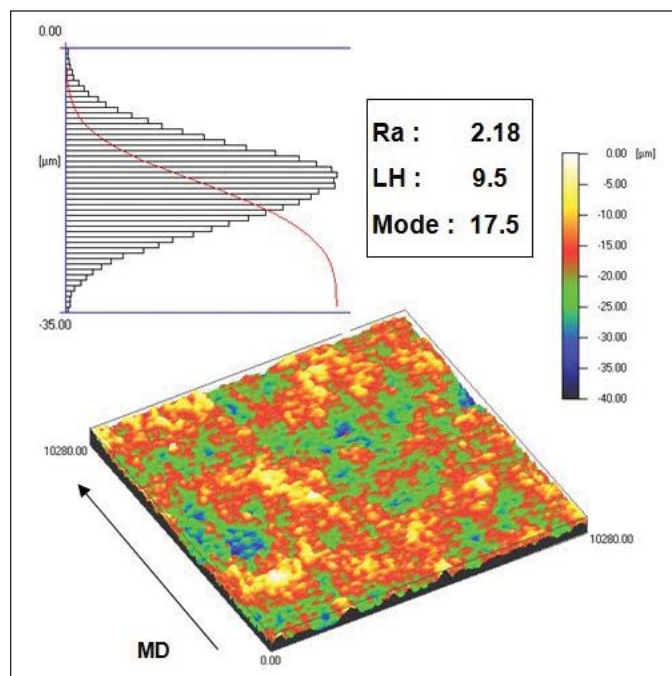
Field trials with Compressor fabrics have shown impressive results. On machines making highly mark-sensitive grades, usually characterized by high filler levels and low basis weights, papermakers report reduced mark, lower energy consumption and higher retention. The increase in retention is due to the improved true fiber support as measured by the WSA. Another typical benefit with Compressor is improved startup and more constant performance over the fabric life, particularly when considering drainage behavior.



regular

sanded

Compressor



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This is due to reduced fabric caliper and void volume.

The bottom line for papermakers is that they will enjoy several additional, measurable benefits:

- Mark propensity is significantly improved due to the smoother sheet side of fabric surface
- The wet end requires no readjustment because the fabric's runnability is uniform over its entire running life
- Reduced power consumption means lower energy costs
- Improved machine cleanliness due to reduced fabric caliper and void volume

### SUMMARY

Fabric suppliers continue to push the technological envelope to bring additional value to papermakers. And each step-change in fabric technology enables the probability for a step-change in paper machine performance and economics.

New technology is also expensive to develop and manufacture. Weavexx has made significant capital investments in new manufacturing technology required to deliver these innovations to the industry. We believe innovation is the lifeblood to not only surviving but thriving together in an ever-increasing competitive global market. ■

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