# CHOMARAT News...

September 2018 - n°6

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# 120 years of innovation and partnership

*Florent TROUBAT*
*CEO of CHOMARAT Group*

In 1898, Auguste CHOMARAT took over a silk mill. 120 years later, CHOMARAT has become an international textile group that is a reference in all of its specialties.

These 120 years have been marked by numerous events and seen truly significant enhancements. After the time of pioneers and bold decisions came a period of growth and internationalization. The Group is now facing a time of new challenges : consolidating its positions for its historic specialties and looking ahead to the materials of the future.

CHOMARAT's development has been driven by the successive generations of leaders and their ability to anticipated trends, innovate, seize opportunities, invest, and also adapt. There have been several astounding success stories, but also significant challenges. The group has strong underlying values of respect, boldness and prudence, long-term vision and the ability to achieve lasting partnerships.

The group's spirit is embodied in the articles in this new newsletter, setting out innovations, partnerships and commitment, applied to the design of new materials that reconcile our need for mobility with energy and environmental considerations.

I extend my thanks to all of our customers and partners for their confidence in CHOMARAT and its employees over many years, and wish you happy reading.

# CHOMARAT and Guy COTTEN, partners for over 50 years

*Guy COTTEN, best known for its yellow oilskins, has clothed professional mariners and leisure sailors alike for over 50 years. Fifty years of ideas, innovations and experiments to provide seafarers with ever greater comfort, strength and safety.*

## Where land meets sea

Fifty years is also the age of the partnership between CHOMARAT and COTTEN. This age is partly explained by the similarities between the two companies. Both have a family structure, an innovative strategy and common values based on trust, confidentiality and high standards.

Everything started in the mid 1960s, with the development of the first fabrics. At COTTEN's request, CHOMARAT worked to develop a double-sided coated fabric that would meet stringent requirements in terms of weather resistance (salty atmosphere) and would withstand greases and aggressive chemicals (detergents).

To prove the strength of his oilskins, Guy COTTEN toured ports, defying sailors to tear the coated fabric.

The first orders poured in, and have never stopped since. CHOMARAT's fabrics are renowned for their flexibility, their endurance and their optimal comfort. They provide unbeatable waterproofing and high resistance to aggressive chemicals.

CHOMARAT and COTTEN – the combination of an innovative coated fabric and know-how in high-performance high-frequency welding.

The seagoing clothing designed by Guy COTTEN is exported around the world (over 30 countries) via its subsidiaries and a close-knit dealer network.

## Evolving materials

The fabric used to make oilskins has retained properties, yet has evolved over time to stay ahead of regulatory requirements (such as changes to plasticizers and stabilizers).
CHOMARAT continues to invest in new technologies which will enable it to develop new environmentally friendly materials offering even greater performance.

### CHOMARAT and Guy COTTEN

*"Because our customers often work in extremely harsh and demanding environments, sometimes under extreme conditions, our duty is to offer them high-performance products.*

*This shared desire for quality led CHOMARAT and Guy COTTEN to work together, and then to build a true partnership over the years.*

*Guy COTTEN's loyalty to CHOMARAT also stems from a true collaboration for innovation, in which both parties are true to their word and uphold confidentiality."*

Nadine BERTHOLOM
Guy COTTEN S.A

*"A relationship built on trust, confidentiality and commitment to a lasting partnership. Demanding standards that push us forward and ensure relentless improvements."*

Philippe CHOMARAT
Coatings & Films business manager
CHOMARAT

# Innovative solutions for lighter and longer wind turbine blade

*The wind market is being driven by the Levelized Cost of Energy.*
*New design and material solutions are proposed for larger wind turbine blades as a very effective way of reducing this cost. The innovative blade design uses asymmetrical skin and spar cap, which have proven to be very effective, reducing the total materials and cost especially for ultra large wind turbine blades.*
*Two types of NCF can be very effective in increasing the performances of longer blades: Unidirectional Carbon NCF for the spar cap as well as shallow angled and unbalanced NCF. CHOMARAT has recently developed C-PLY™ UD for the thick carbon spar cap with high permeability and C-PLY™ BX and TX with customized tow angles.*

## C-PLY™ UD for extra thick laminates

C-PLY™ UD laminates are developed as thick UD carbon fabrics with special stitching technology providing high permeability.

While infusion processes are well established for thick glass laminates, it is much harder to infuse a thick carbon part, due to the thinner diameter of carbon fibers. To help the wind market increase the use of carbon, CHOMARAT has developed a carbon UD, under the brand C-PLY™, specifically tailored to enable thick infusions.

Thanks to a specific stitching combination, this new C-PLY™ UD allows for extra thick laminate infusions, up to 90 mm (150 layers stacked and infused without the help of any internal flow media), where classic constructions of UD NCF allow no more than 20-25 layers.

The development has been conducted in close partnership with major blade manufacturers, to best tailor this C-PLY™ UD to their requirements and manufacturing method.

The key objective was to increase the permeability, while keeping a high fiber volume fraction. In such thick and long parts (up to 80m length), every 1% decrease of fiber volume fraction leads to an extra consumption of approximately 100 kg of resin. This new version of C-PLY™ UD is the right compromise between high permeability and high fiber volume fraction.

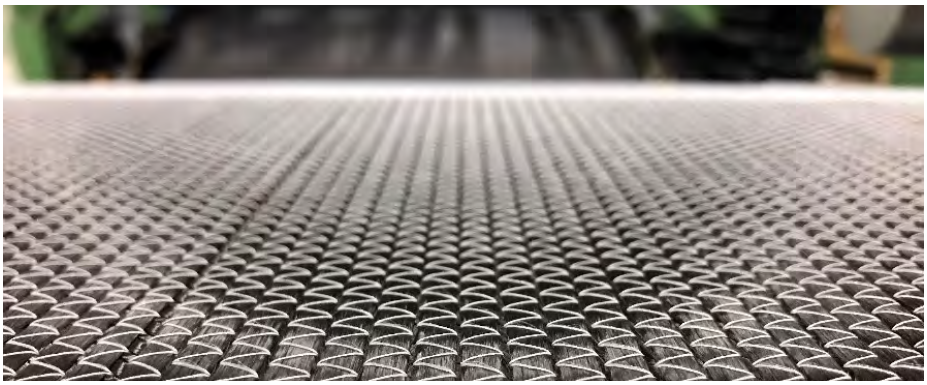


*Figure 1*
*C-PLY™ pure UD with specific stitching to increase permeability*

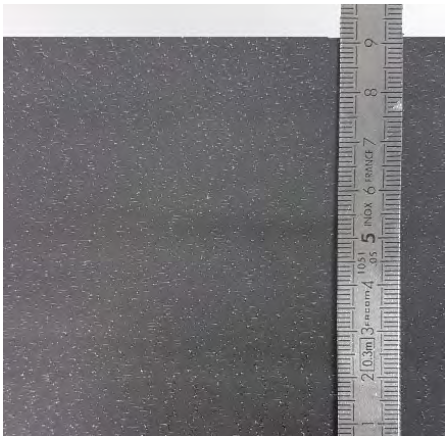


*Figure 2*
*Close-up of 150 ply laminate*
*92 mm mean thickness*
*Porosity levels lower than 1%*

### C-PLY™ for tailored performance

C-PLY™ allows for various design requirements, i.e. a wide range of angles (25 to 85 degrees) in the biaxial and triaxial NCF, unbalanced glass and carbon hybrid fabrics and thin NCF. Shallow angled NCF can be tailored to optimize the ratio between bending and torsion. The unbalanced NCF can also be effectively used in this Bend-Twist Coupling (BTC) blade, which can migrate the wind loads and extend the fatigue life especially in larger blades. Chomarat launched the research and development program early in 2011 to best fit the BTC blade.

An innovative blade design using asymmetrical skin and spar cap is proven to be very effective, reducing the total materials and cost especially for ultra large wind turbines blade. An asymmetrical hybridized spar cap combining glass and carbon fibers can increase efficiency even further.

C-PLY™ laminates are now available on the market for larger blades.

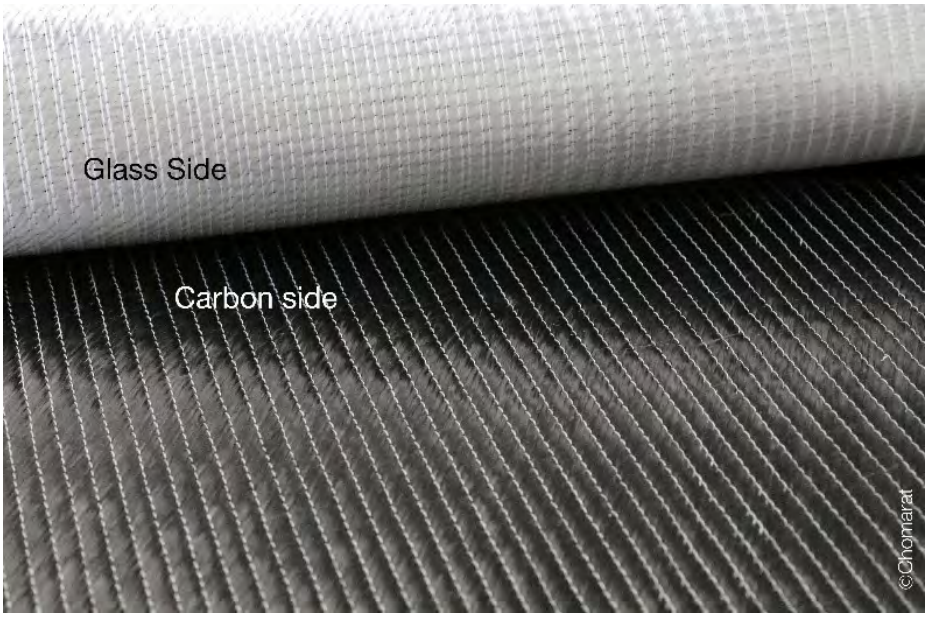



*Figure 3*
*C-PLY™ hybrid structure - carbon/glass*

### WIND ENERGY UPDATE

New capacity installed in 2017 : +52,5GW

Total cumulative capacity end of 2017: 539,6GW

Top 3 installing countries in 2017 :
- China (37%),
- USA (13%),
- Germany (13%)

Record year for Europe : +16,8GW installed (+16% vs 2016)

Record year for offshore installations: +4.2GW (Almost x2 installed vs 2016)

Source : GWEC

# Non Crimp Glass and Carbon Fabrics with high resistance stitching yarn for thermoplastics processes in automotive and aerospace applications.

*Over the last five years, the composites industry has developed many innovative high-performance solutions through thermoset applications with the goal to bring automotive manufacturers lightweight options to help in decreasing CO2 emissions to meet regulatory targets. The key challenges for these new materials are cycle times and costs.*

*Thermoplastics composites offer the automotive and aerospace industry a real technology breakthrough. Thermoplastics in general give mechanical performance similar to epoxy but are generally tougher than epoxy. They can be remelted, so are easy to recycle, and offer new part welding solutions.*

*Current thermoplastic composite solutions (woven fabric based organo-sheets or UD prepreg) still have limitations due to costs or performance optimization.*

## Overcoming high temperature challenge

Some years ago, CHOMARAT entered into the development of alternative fabrics made upon multiaxial technology (Non Crimp Fabric – NCF) as a key process to allow cost reduction in the future but also bring new design possibilities, particularly in terms of angles.

NCF are stitched UD in different angle directions. In order to use these fabrics in high temperature thermoplastic composite manufacturing processes, there was a key technical challenge to overcome: the heat resistance of the stitching yarn. Thermoplastics processes can exceed 300°C for polyamide systems or even 380-400°C for high performance thermoplastics such as PEEK or PEKK.

*Figure 1 G-PLY™ haute température*

The NCF reinforcements currently available on the market cannot be used in thermoplastic processes because the stitching yarn traditionally used (polyester for example) melts at thermoplastic processing temperatures. The reinforcing fibers of the NCF are no longer maintained, and are disoriented. The reinforcement then loses its initial mechanical properties.

## An innovative stitching yarn

CHOMARAT has been developing a new stitching yarn specifically for multiaxial processes, enabling it to propose to the market a new series of reinforcements suitable for thermoplastic developments.

These new multiaxial reinforcements patented by CHOMARAT are made both with carbon and glass fiber and the stitching yarn is designed to be compatible with the thermoplastic used in the final composite.

For example, NCF stitched with glass/polyamide mixed yarn is available for glass/polyamide composite applications. New solutions are also being developed for high performance composites based on PAEK resin and carbon fiber.

These new solutions bring the advantages of multiaxial products (optimized reinforcement, angle possibilities, higher performance and better surface appearance on the final part) to the thermoplastic composite field.

The NCF glass range for thermoplastic will be launched in 2019.

# ROTAFLEX™ NÉO, an asset for waterproofing membranes

*Roofing architecture is constantly evolving and coming up with new applications (terraced, landscaped, sloping), along with new requirements in terms of waterproofing and insulation. The roofing industry faces new environmental and economic challenges. With ROTAFLEX™ NÉO, CHOMARAT offers new reinforcement solutions for waterproofing membranes.*

**ROTAFLEX™ NÉO :**

**Reinforcement like no other on the market, combining the performances of grids and nonwoven fabrics in a single layer.**

ROTAFLEX™ NÉO is the result of collaboration between CHOMARAT, which has 40 years of experience in the roof waterproofing market and is an expert in the design and production of grids, and Norafin, which has specialized in hydraulically-bonded nonwoven fabrics for 35 years.

ROTAFLEX™ NÉO comprises a grid of glass fiber threads with two nonwoven polyester fabrics. The complex fabric is assembled using a water jet bonding process, to ensure the integrity of the grid's performances. The complex is then coated with a bonding agent which gives it strength, avoids dispersion of the threads at the surface, and facilitates machine use.

Glass grids present several advantages. The intrinsic properties of glass result in dimensional stability on roofs and on membrane production lines, offer higher tensile strength and contribute to the fire resistance of the waterproofing membrane.

Non-woven polyester combined with the specific hydrobonding procedure, provides the composites with static piercing resistance and resilience.

## Complexing by hydrobonding

The specific hydrobonding procedure offers control over the air permeability of the complex, and thus of the bituminous membrane, enabling the reinforcement to be quickly impregnated on the bitumen impregnation line, even at high speed.

Another advantage of this process is the control it gives over the surface appearance of the complex. It is possible to obtain a very smooth and uniform appearance, suitable for the most demanding applications.

ROTAFLEX™ NÉO is the ideal reinforcement for bituminous membranes subjected to extreme conditions of use. It retains excellent flexibility at very low temperatures.

The ability to control the permeability and the surface appearance enables this reinforcement to be used on multiple production lines (single and multiple impregnation) and in products where appearance is a decisive advantage.

## ROTAFLAM™ NÉO, for added fire resistance

CHOMARAT has also developed ROTAFLAM™ NÉO, a reinforcement incorporating a glass film for greater fire resistance.
ROTAFLAM™ NÉO, combined with a specific membrane design, reduces the risks of flame propagation. It creates a barrier which prevents burning bitumen from passing through the reinforcement and propagating flame to the building's insulation. Membranes produced with ROTAFLAM™ NÉO pass flame resistance tests with flying colors.

# C-TAPE™, reinforce the «Figaro Beneteau 3 » foils

*For the series production of the foils, the Beneteau Group chose MULTIPLAST, the well-known builder of racing boats, which engaged the CHOMARAT Group to provide project support and achieve the best cost/performance balance.*

The project was ambitious, Multiplast had to reach a lower target cost, achieve a perfect foil shape, guarantee identical weight for all parts, and produce a set of foils per week over a period of one year.

For this project, CHOMARAT has developed a unidirectional woven tape, designed to meet the standards of industrial production for these appendages.


*Figaro Beneteau 3*

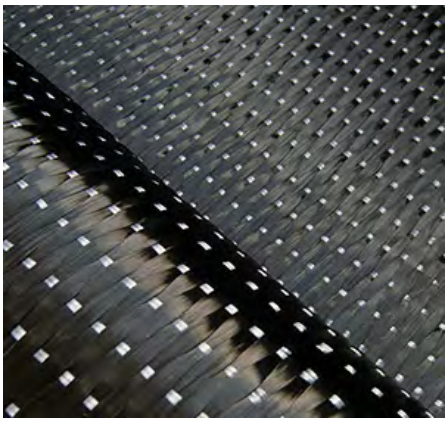
## C-TAPE™, a high-performance carbon reinforcement with great design flexibility

C-TAPE™ offers a lot of flexibility in terms of weight, width and construction. It has been optimized to facilitate series production, yet provide the foils with maximum performance. The weft yarn developed by CHOMARAT makes the tape easy to handle and to work with. It is produced in 50-cm widths in order to adapt better to the mould, thus reducing both scrap and production cost.

## A reinforcement that facilitates flow in multi-ply carbon structures

Fifty plies of tape are used to make the foil so that it can resist high levels of stress and achieve optimal performance.
The specific structure of C-TAPE™ facilitates resin flow throughout the thickness. The reinforcement provides the desired mechanical performance and also cuts down on production time. The result is an ultra-innovative foil, both for its geometry and for the fabrication process (infu-jection) used. This new C-TAPE™ is the fruit of close co-operation between the MULTIPLAST and CHOMARAT development teams, and it rounds out our broad range of tapes.

CHOMARAT is working on different fibres and adapting the widths to customers' processes in order to reduce costs.



*C-TAPE™ U800 P2/1 24K F*

By the end of summer 2018, some one hundred foils will have been produced for assembly on the first 50 "Figaro Beneteau 3" monohulls.

# L-RTM Production of Transit Bus Components with CHOMARAT's ROVICORE™ and COREGLASS™

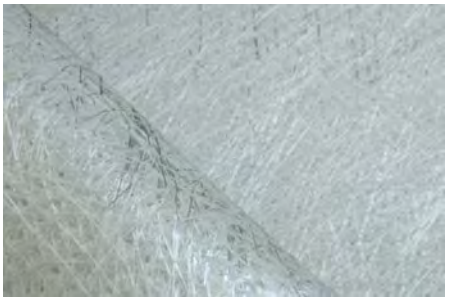
*TPI Composites is a global composite manufacturer with operations in North America, Europe and Asia, specializing in the Wind, Transportation and Defense industries. With 8,500 employees and $930M revenue in 2017, expertise in large complex structures and high volume production facilities, they are leaders in composite engineering and manufacturing.*

TPI uses a product development approach that emphasizes making sure materials and processes meet the design criteria of the project. Final parts need to meet demanding standards including, physical properties, cosmetics, durability, fire protection and corrosion resistance. Processes need to be capable of producing multiple parts per day per mold to achieve high volume production rates and tooling needs to support consistent part thickness and overall quality.

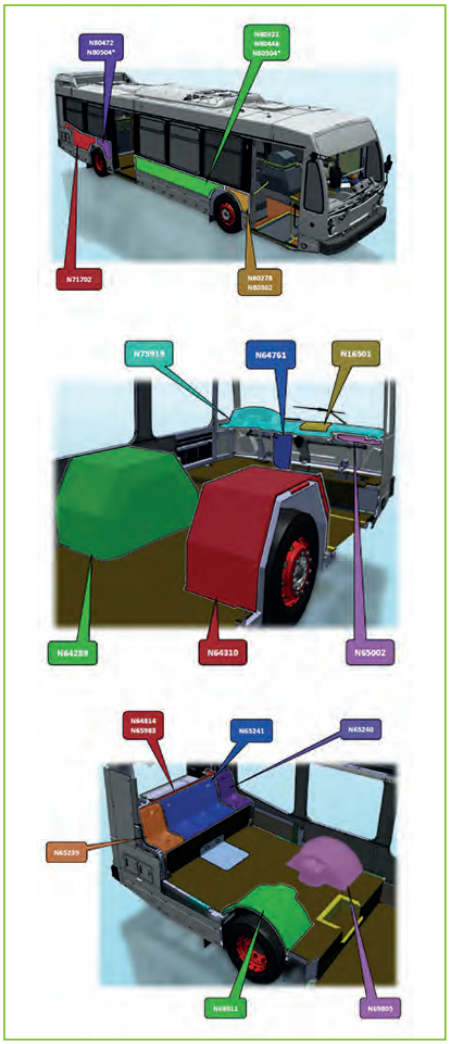
TPI chose CHOMARAT's ROVICORE™ and COREGLASS™ as the best solutions for their Transit Bus components.

ROVICORE™ is the industry reference for closed mold processes like L-RTM and Infusion. It's a reinforcement and flow media in one highly conformable fabric. ROVICORE™ compresses to a parts designed thickness while maintaining a highly permeable core for fast resin transfer. It's uniform layers of chopped fiberglass sandwich a needled core providing excellent surface quality right out of the mold. COREGLASS™ shares ROVICORE's attributes and adds additional glass fibers in the Z-axis of the reinforcement. This additional glass is needled through the synthetic core and increases bending properties of finished parts by 20-25%.

COREGLASS™ is also a choice for reusable CCBM infusion processes as it's resistance to compression under vaccum help to maintain the desired part thickness.



ROVICORE™



Components
with Chomarat's Rovicore™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