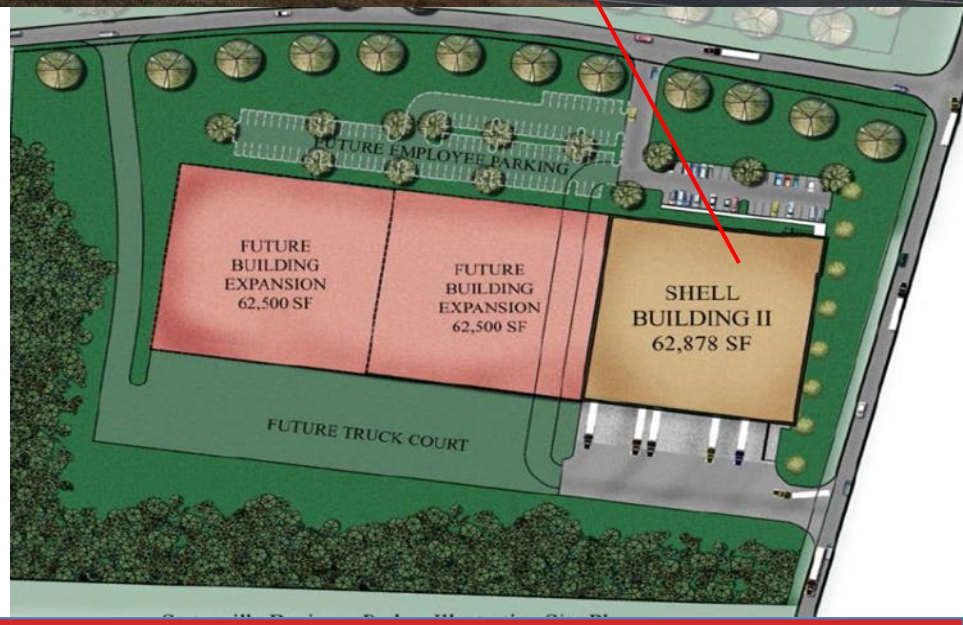
Highland
Composite Structures

Highland Composites

- New state-of-the-art ~63k sq. ft. facility including 4k+ sq. ft. clean assembly room, 2k+ sq. ft. quality lab, ample shipping with dock and ramp loading.
- Expandable on-site to ~188k sq. ft. (expansion area purchased and graded).
- Strategically located with easy access to multiple interstates systems, deep water ports and rail system.



What Are Composites?

Composite Materials - defined as a combination of two or more distinct materials, each of which retains its own properties but when combined, creates a new material with properties that cannot be achieved by any of the constituents acting alone.

Highland Composite Structures utilizes advanced material processes with high strength fibers in the form of fabric preforms or tows. These reinforcement materials are combined with thermoset or thermoplastic resin systems to create a variety of lightweight parts and assemblies to meet customer needs.

Carbon Fiber

Fiberglass

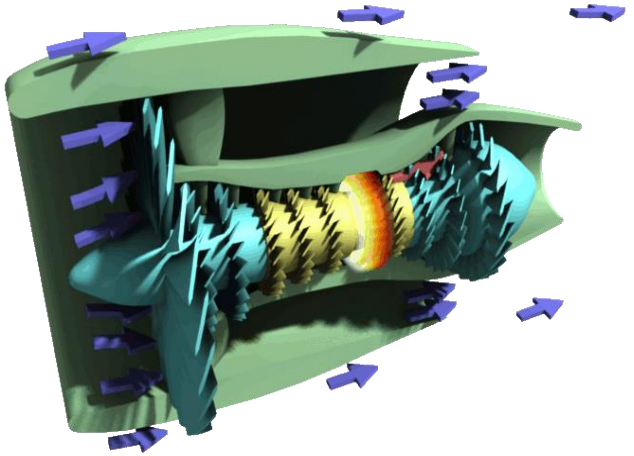
High Strength Polymers

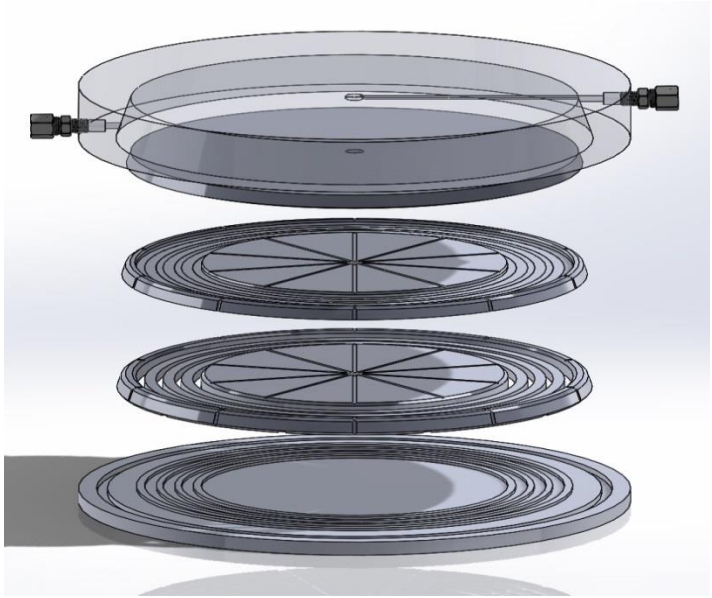
Aramid

Engineering

Highland provides full service engineering from conceptual design and analysis to prototyping, tooling and testing.

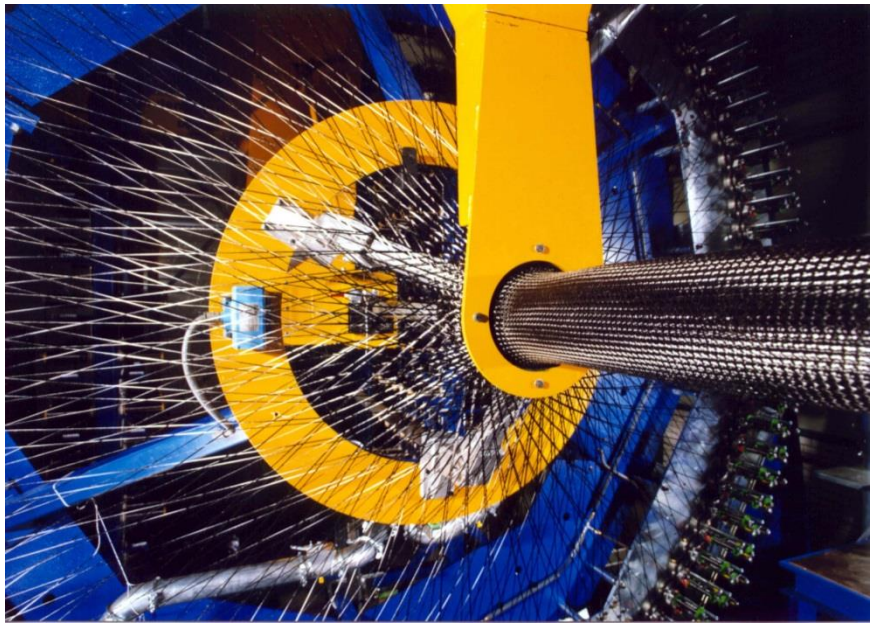
Highland Employs the Following Software Systems:
- ✓ CATIA® V5 6R2014
- ✓ CATIA® Composites Software for ply definition
- ✓ Solidworks Premium with Simulation





Engineering Capabilities Include:
- ✓ Part design and analysis
- ✓ Materials and Process Design
- ✓ Mold tooling design – Composite and metal
- ✓ Prototype design and manufacture
- ✓ Process Engineering

Braiding



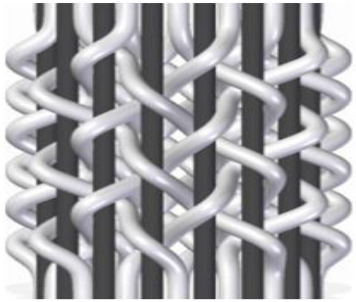
Braid makes composite parts stronger, tougher and more damage tolerant, while providing uniform, repeatable orientations for complex geometries and enabling dramatic composite processing improvements. Braids are used to manufacture lightweight and rigid products, some examples being automotive and aerospace structures, sporting equipment, drive shafts, and propeller blades.

Conventional braids are manufactured in a variety of product forms:

- Hybrid braid
- Hybrid yarn
- Sleeves
- Broad-goods
- Uni-directional
- Non crimp braid
- Bi-axial
- Tri-axial
- 1/1 Diamond
- 2/2 Regular
- Custom Architectures

Aramid and Carbon Fiber Braid

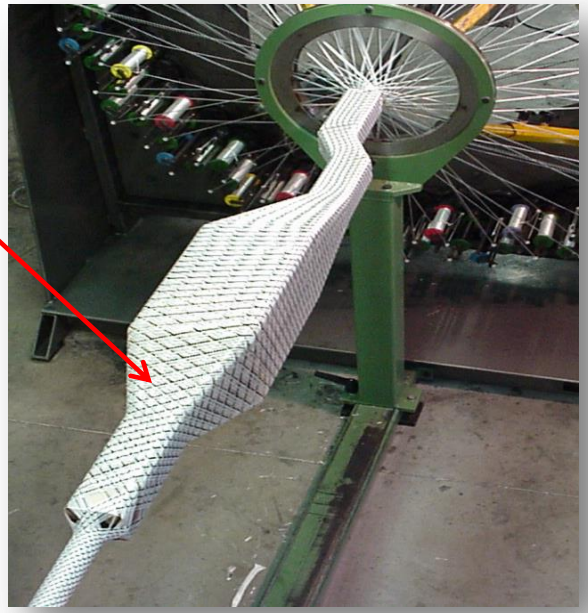
Triaxial Braid



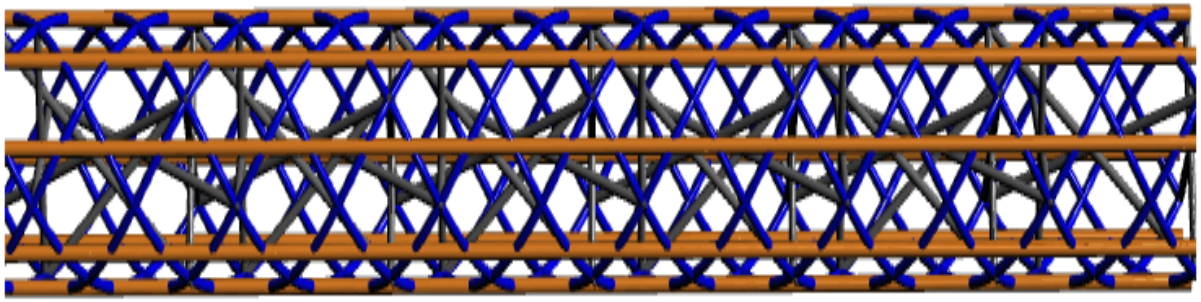
Custom Braiding

Highland offers advanced braiding capabilities to fit custom applications.

Over-Braiding - Fibers are braided directly onto a core or mandrel determining the final shape and dimension of the product. Highland offers braided preforms which our clients can place in a mold and inject with a resin system or we offer cured parts ready for assembly.

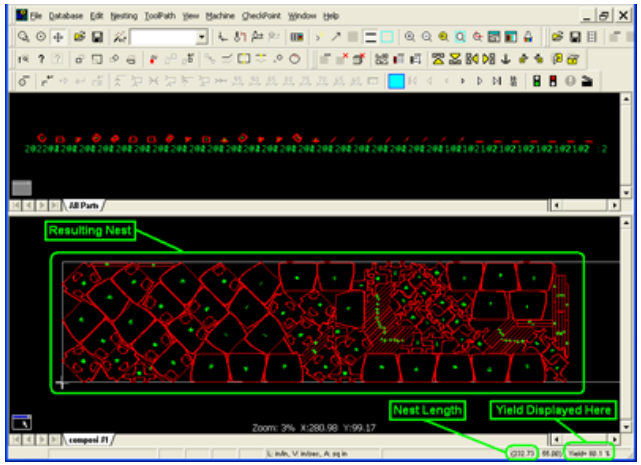


Open Structures - The open braid process produces a composite truss structure which has a higher strength to weight ratio than standard composite structures made from resin infused fabric or from solid filament wound composites. Highland employs a proprietary patented process to create these open structures.



Kit Cutting

The fabrication of a laminated composite part starts with the cutting of the material into precisely sized patterns with defined orientations generated from the 3D CAD model. Woven broad goods (prepreg or dry) are precision cut using our automated CNC Gerber ply cutter to control the cutting, minimize waste, and achieve much tighter edge tolerances over hand cutting. Once cut, materials are grouped according to the work instructions and mated with other plies to form the kits needed to create an individually designed part.

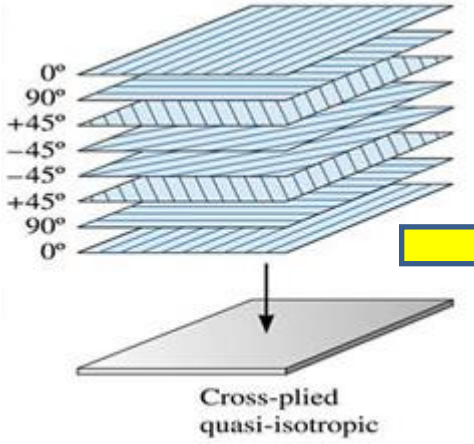


Our 30’ x 20’ Drive-in freezer provides 0°F storage for prepreg fabrics to maintain their shelf life.

All fabrics and prepregs are lot/batch controlled for traceability.

Preform Layup

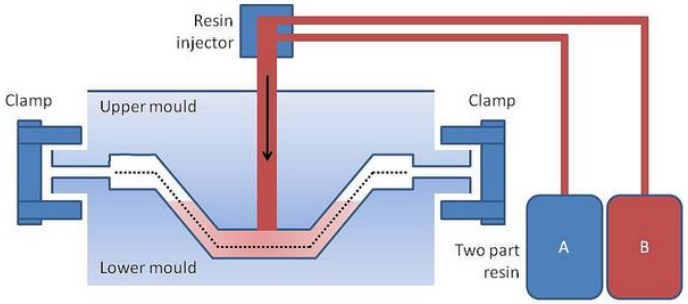
Composite material which has been precision cut and organized into individual kits, are laid into molds according to detailed assembly plans that determine specific placement and orientation of the material to achieve the desired physical characteristics of each part. The molds are then assembled (if closed metal molds are used) or vacuum bagged dependent upon which curing process is required.

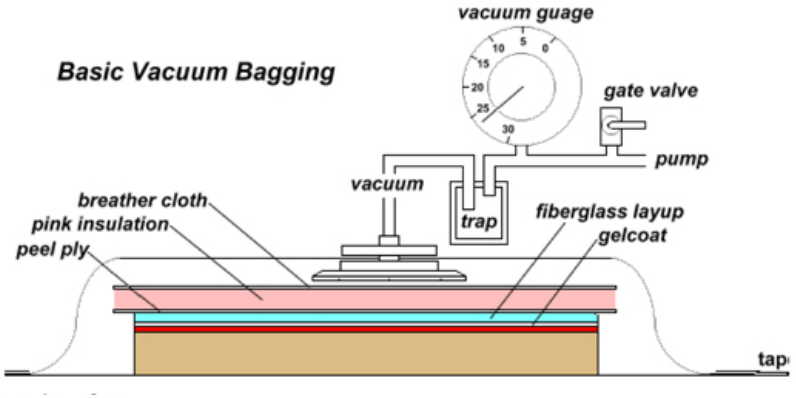


Highland's 4,000+ sq. ft. assembly room provides environmental and FOD (Foreign Object Debris) control for all kitting, lay-up and assembly processes.

Composite Molding – RTM/VARTM

RTM and VaRTM are the processes of introducing a resin system into a mold containing a lay-up known as a preform. Once the resin is successfully infused and carefully cured, the finished component can be removed and trimmed. Highland uses a wide range of resin systems. In addition to standard systems, we offer BMI systems for high temperature applications as well styrene free "no VOC" green systems. Preforms can include glass, carbon, aramid, polymer synthetics, metals or some combination of these and other fibers depending upon the characteristics desired in the finished part.



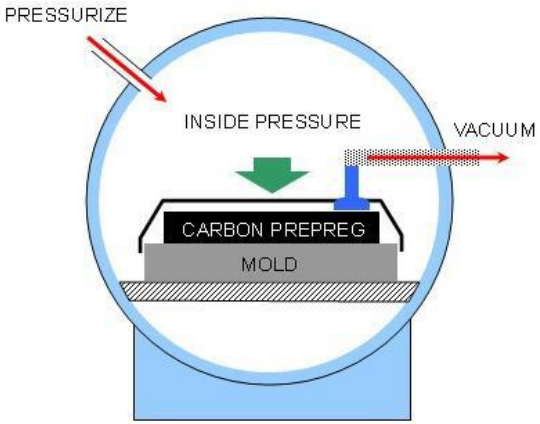


Resin Transfer Molding (RTM) produces parts to the desired shape with tightly controlled tolerances, good surface finish, low void content, and with the required levels of fiber volume. Raw material costs for the resin transfer molding process are typically lower than those associated with pre-impregnated materials, although tooling costs are higher for the required closed molds.

Vacuum Assisted Resin Transfer Molding (VARTM) uses an open mold system in which the mold is enclosed with a vacuum bag and a vacuum applied to compact the preform. Resin is then introduced into the lay-up. Since VARTM does not require high temperature or pressure, it is associated with a lower tooling cost, making it possible to produce inexpensively large, complex parts in one cure cycle.

The VARTM process has been successfully used to make both thin and very thick laminates, as well as large parts with complex shapes and unique fiber architectures for high structural performance.

Autoclave Processing



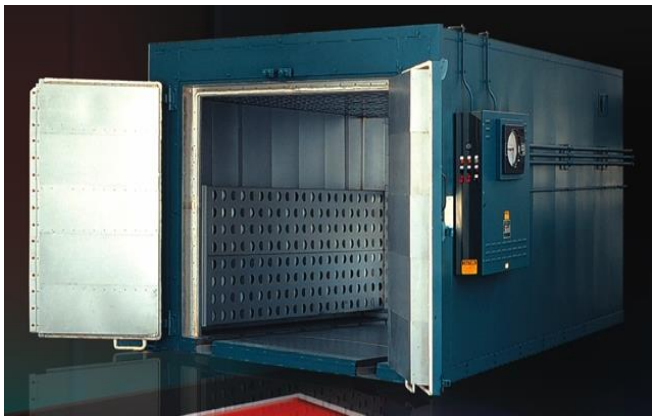
Pre-impregnated fabrics or tows must be cured with a slightly different process to ensure compaction of the multiple layers of material. Once the material is placed into a mold it is sealed with a vacuum bag. Vacuum is applied to compress the layers of composite material in preparation for autoclave processing. The uncured molded parts are placed into the autoclave and maintained under vacuum. Heat and pressure are added which aides in the compaction as well as helps to flow the resin throughout the lay-up to create strong, rigid, lightweight parts.

Highland Composites has chosen ASC, one of the most premier autoclave manufacturers in the world, as our exclusive autoclave provider. ASC's rich history in the autoclave industry combined with their proprietary state-of-the-art "CPC" operating system make this combination a "win – win" for Highland and our customers.

Composite Molding Equipment

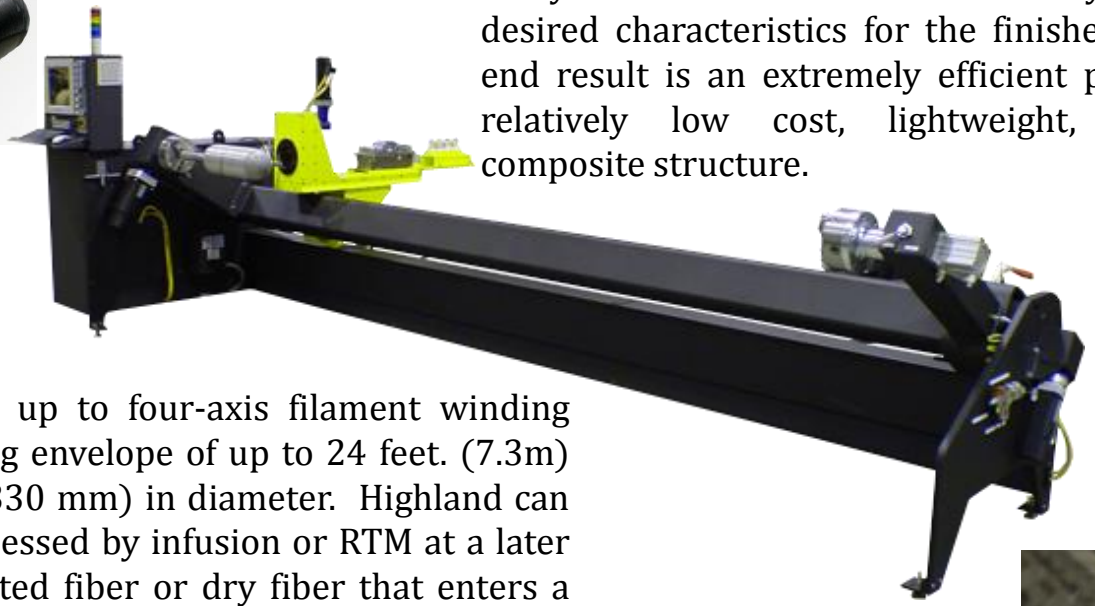
- 200 Ton Press with heated platens capable of up to 1000°F (538°C)
- RTM Injection Systems for Epoxy and PE/VE Resins Equipped with data logging
- Batch Oven 4'x5'x6' (1.2mX1.5mX1.8m) for curing small parts
- Large Composite Ovens
  10'x10'x8' (3mX3mX2.4m)
  10'x10'x25' (3mX3mX7.5m)
  Heats to 500°F (260°C)
  Equipped with vacuum ports and Thermocouple connections.
  Controller with data recording

- 12' x 6' (3.6mX1.8m) ASC Autoclave
  Equipped with vacuum ports and Thermocouple connections.
  Proprietary CPC software
- All Systems Networked with Off-Site Data Storage.

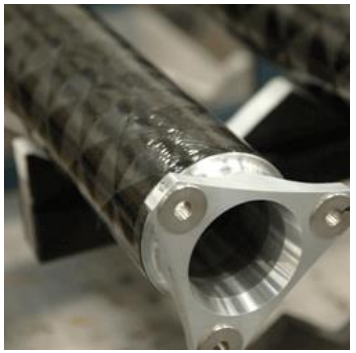


Filament Winding

Filament winding is the process of winding fibers onto a mold known as a mandrel to create a composite structure. It is typically used to create circular or oval composite products with a hollow core and can utilize many different fibers and resin systems to achieve desired characteristics for the finished component. The end result is an extremely efficient process to create a relatively low cost, lightweight, yet ultra-strong composite structure.



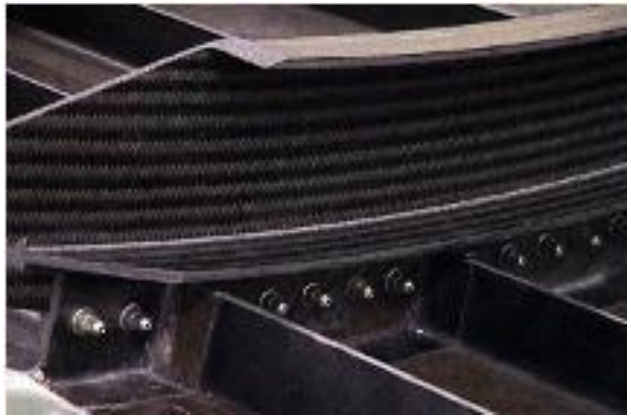
Highland Composites has up to four-axis filament winding capabilities with a working envelope of up to 24 feet. (7.3m) in length and 13 inches (330 mm) in diameter. Highland can wind dry fiber (to be processed by infusion or RTM at a later time), resin pre-impregnated fiber or dry fiber that enters a resin bath prior to winding (known as wet winding). These capabilities allow Highland to produce parts such as pressure vessels, pipes and drive shafts.



Combining the filament winding process with Highland's proprietary advanced braiding technology allows us to achieve stronger and more impact resistant structures not found with conventional winding.

Assembly and Finishing

Our assembly process includes a wide range of capabilities from complete trim and post machining to mechanically attaching sub-assembly components to adhesive bonded joints.



While many customers desire the natural finish of composites, others may require priming and/or painting, such as aircraft fairings or automotive panels. This may also include applying customer labels as seen on many sporting goods. Highland has full finishing capabilities in-house and can deliver parts and structures at whatever level of finish the customer requires.