



MANUFACTURING & PROTOTYPING CAPABILITIES

CCM Equipment

Autoclave: Thermal Equipment Corporation autoclave, with capability to 1200 F and 500 psi. Chamber working size is approximately 20in diameter and 4ft in length

Compression Molding Press: 2ft x 2ft 150 ton Wabash heated platen (800°F) press

Liquid Molding: Multiple VARTM workcells with all necessary accessories, 2100cc High Temperature RTM injection systems, a SMARTMolding fully automated VARTM workcell, elevated temperature VARTM for BMI and toughened epoxy infusion, Co-Injection Workcell, process monitoring sensors, and all associated process control hardware, permeability characterization and Measurement System

Robot-based ATL & AFP Machine: Processes thermoset, thermoplastic, and dry-fiber pre-preg fibers/tapes for flat, cylindrical, and contoured parts. Features head-exchange system for material flexibility and tool-less thermoplastic placement.

Mandrel Surfaces: Open shape (flat, parabolic), Closed/open shape with rotational axis (cylindrical, box beams, concave/convex parts).

Thermoplastic Extrusion & Film Line: DACA Micro- Compounder (5cc max capacity), Twin screw Haake Extruder (480 C, 14 kg/hr) and Film line, Perkin Elmer Series 2000 GPC Lab Scale Film Extrusion System

Microwave Processing: 3kW microwave processing system

Induction Heating: 5kW heaters for polymer and metal matrix composite processing

Automated Lamination System: Roller based heating and consolidation system for automated processing of thermoplastic and thermoset preregs

Ovens: Wisconsin Oven-Convection Oven 8ft x 10ft x 8ft chamber (500 °F), Blue M-Convection Oven 3ft x 3ft x 4ft chamber (500 °F)

Fabric Prototyping & Tow Sizing System: CCITech SL8900 Sampling Loom System (2-D Loom, Warper, Sizing Unit)

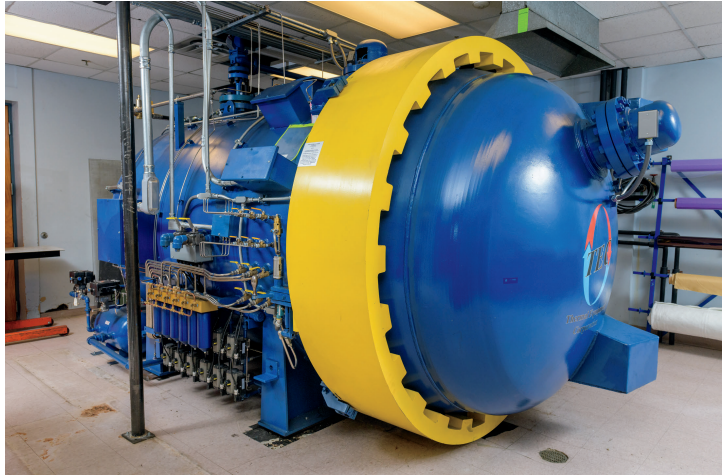
Ultrasonic Welding: Amtech Ultraseam 20 Robotic Consolidation System

Environmental Aging Test Facility: Includes 4 Tenney environmental chambers that support long term conditioning of composites for combinations of temperature and Relative Humidity, multiple QUV chambers for long term conditioning of composites for UV exposure and an Atlas Weatherometer that simulates exposure to moisture and sunlight.

High Temperature Furnace Facility: This facility consists of a Carbolite Gero furnace with 1000 C temperature capacity and controlled atmosphere, and a 3000 C Carbolite graphitization furnace for use in Carbon-Carbon composite development.

CCM-ATTL Equipment

CCM's Application Technology Transfer Laboratory (ATTL) was established in 2005 as an off-site facility to provide additional space for sub-component and full-scale part manufacturing and



prototyping. Facilities at ATTL are used to demonstrate production processes at rate and quality.

Pultrusion: HPI 20 kip Pultrusion Machine

Prepreg Line: Aqueous Bath Thermoplastic Prepreg Line

CNC Automated Ply Cutting: American GFM Model US15 Ultrasonic ply cutter with fabrication/assembly capabilities of bound dry preforms

Liquid Molding: VARTM workcells including SMARTMolding with elevated temperature capability, and a 44ft x 14ft x 12ft dedicated climate controlled booth for process condition control and ventilation

Filament Winding: Entec Filament Winder Experimental Thermoplastic Lamination Workcell CNC Machining: HAAS VF-9/40 Vertical Machining Center

Metrology: 3D Laser Scanner/Coordinate Measuring Machine, Virtek Laser Projection System Spray Systems, Inc. Commercial Spray Booth: 34ft x 14ft x 12ft

Component Trimming & Finishing: Specialized composite cutting equipment and dust collection controls

Assembly & Integration: Large scale composite structures and vehicle applications, including systems integration for electronics and electro-mechanical systems

Extrusion System: Krauss Maffei ZE25 Twin-screw extrusion system for continuous compounding of thermoplastics and fiber-reinforced materials, with a throughput of up to 25 kg/hr. Ideal for pelletized feedstock for molding.

High-Pressure RTM (HPRTM) – Hennecke Streamline: Advanced HP-RTM system using axial piston pumps and MN10 mixhead for high-flow epoxy injection (up to 150 cm³/sec) at pressures up to 160 bar, with precision control over flow, pressure, and temperature.

IsoJet RTM System: Low-pressure RTM unit with gear pumps, suitable for 2K epoxy resins with a flow range of 100–500 cc/min and operating pressures up to 21 bar (305 psi), supporting adjustable mix ratios and heated dispensing.

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