

UD-CCM Manufacturing & Prototyping Capabilities

New at CCM: Hennecke GmbH High Pressure Resin Transfer Molding System (HP-RTM)

The first open-access HP-RTM workcell in the United States allowing for:

- Manufacturing ultra-lightweight, high-performance composite structures
 - Traditional HP-RTM
 - Compression RTM
 - Wet Compression Moulding
 - Materials Development (resins, core, preforms, etc.)
- Prototyping
 - Small to medium production runs
 - Industry sponsored programs
 - Academic partnering
 - Government programs

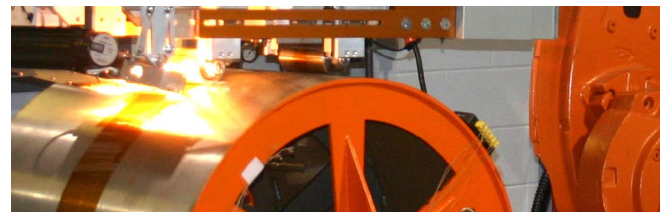
CCM Equipment

- **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, 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
- **Robotic Tape Placement:** ABB 6400 six-axis robot with custom designed heads – Computer-Controlled N2 Hot Gas Torches (2), 10 kW Huettinger Induction heater, IR heaters, all necessary hardware and process control systems
- **Thermoplastic Extrusion & Film Line:** DACA Micro-Compounder (5 cc 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 prepregs
- **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

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



Technical Contacts:

Shridhar Yarlagadda, Ph.D. | 302.831.4941 | yarlagad@udel.edu

Dirk Heider, Ph.D. | 302.831.8898 | heider@udel.edu

Dan Molligan | 302.831.7410 | molligdj@udel.edu