College of Architecture, Planning & Landscape Architecture

RhinoCAM®

RhinoCAM at The University of Arizona

The University of Arizona College of Architecture, Planning and Landscape Architecture Material Labs is an extension of the University of Arizona's pedagogical mission to provide environments to explore, model, fabricate, and test design ideas. The labs encompass a 9,000 sq. ft. facility providing a professional quality environment and equipment accommodating a wide variety of materials including metals, woods, concrete, ceramics, glass, plastics, CNC tools and digital fabrication.

Students Learn RhinoCAM!

MecSoft Corporation recently had the opportunity to sit down with (Name Removed), the Material Labs Manager at the University of Arizona College of Architecture, Planning and Landscape Architecture to discuss how RhinoCAM is an integral part of the multi-year learning process for students in his Material Labs classes. Here is an excerpt of what Paulus had to say about RhinoCAM.

"We use Rhino exclusively for 3D modeling and design so RhinoCAM is a excellent fit for us. Learning RhinoCAM is integrated right from our beginning classes where students learn how to integrate toolpaths into their design projects and run the g-code on our ShopSabre CNC routers."

Material Labs Manager , University of Arizona College of Architecture and Landscape Architecture

The Material Labs Manager (disallowed us to use his name) also shared with us a few very interesting design projects his students have produced. In these projects, students apply RhinoCAM, not only as a traditional subtractive machining method but also as a design technique, where the CNC toolpaths produced by RhinoCAM themselves become an integral design feature. We hope you enjoy reading about these cool projects.

Watch some cool projects using MecSoft's CAM in Education Webinar

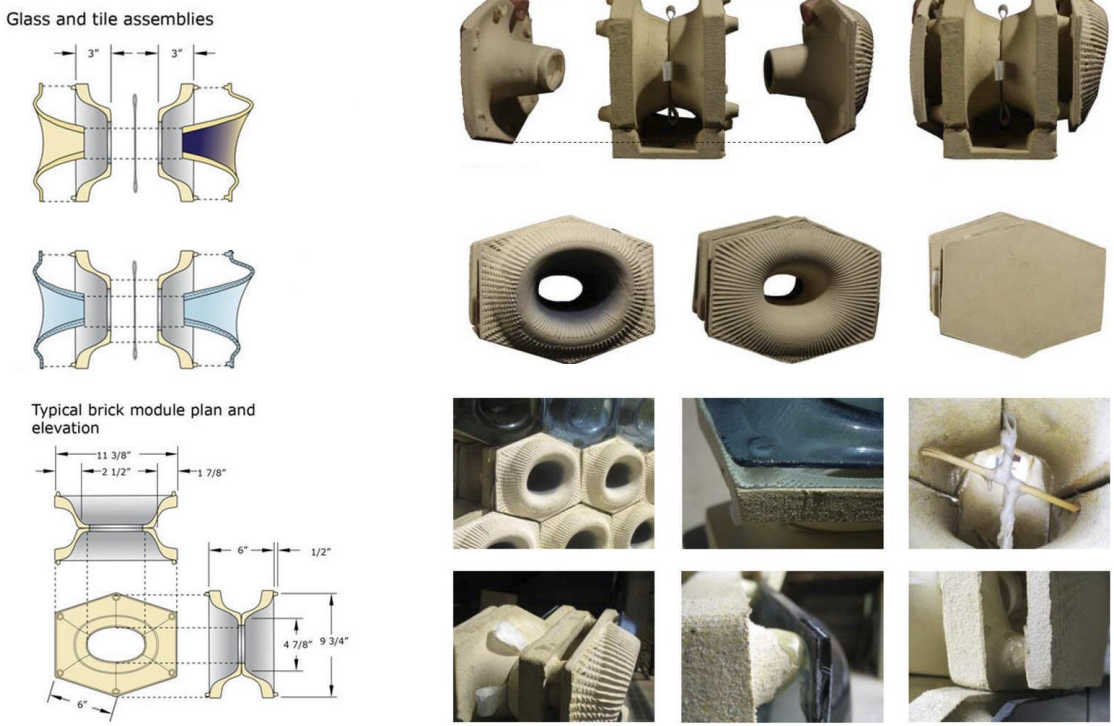
Want to see how RhinoCAM can help you? Click Here to download a demo!

Next Generation EcoCeramic Building Materials

Designer: Jed Laver

In this project Jed uses RhinoCAM in the process of making the ceramic tiles for his next-generation EcoCeramic CMU (Concrete Masonry Units). The master molds were cut from MDF (Medium Density Foam) using 3 Axis RhinoCAM toolpaths. The MDF master molds were then used to form ceramic mold halves. These ceramic molds were further machined using RhinoCAM toolpaths allowing for many prototype design iterations. The final iteration of the ceramic mold halves were then used to produce a few hundred components, blocks, enough to build and test an entire wall using the EcoCeramic CMU design structure.

Similar to a CMU block, the goal was to make a tiled wall structure for an outdoor amphitheater (in the desert southwest) that lets light in while keeping the excessive heat out. CNC is used creatively allowing the toolpaths to create the design itself as shown in the image above.



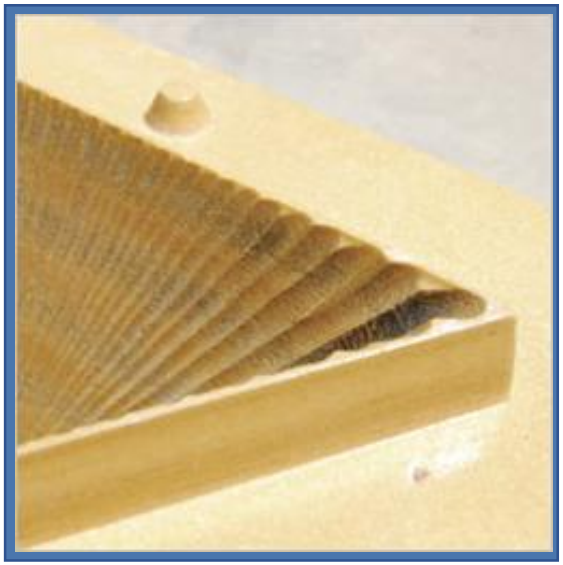
Next Generation EcoCermac Building Materials, Designer: Jed Laver, RhinoCAM CNC Toolpaths are used to machine master ceramic mold halves with cutter path design characteristics.

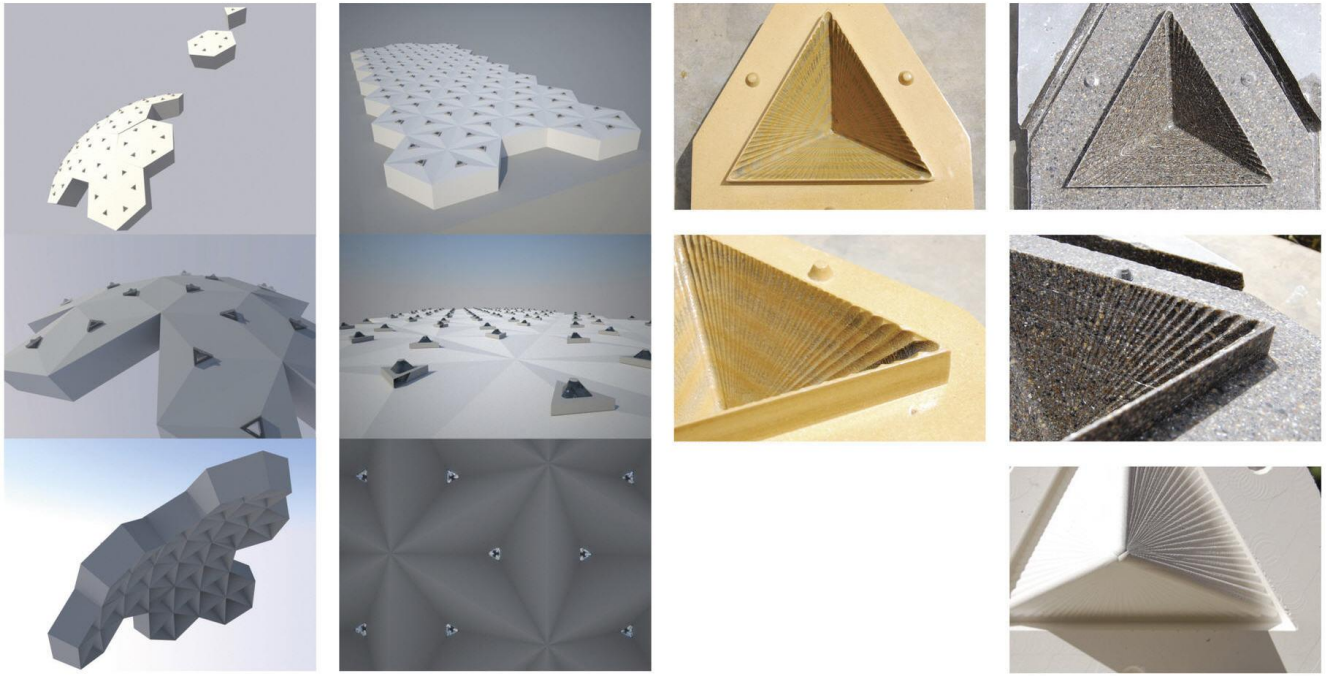
Next Generation EcoCermac Building Materials, Designer: Jed Laver, RhinoCAM CNC Toolpaths used to machine master ceramic mold halves from MDF (Medium Density Foam) material.

Light Container Fabrication

Designer: Ben McDonald
In this project Ben designs and fabricates a tile system used to disperse incoming sunlight. The design incorporates RhinoCAM toolpaths that are used to help refract the incoming light along the cutter paths. Here on the right we see one of the design iterations for the slip-cast ceramic mold halves.

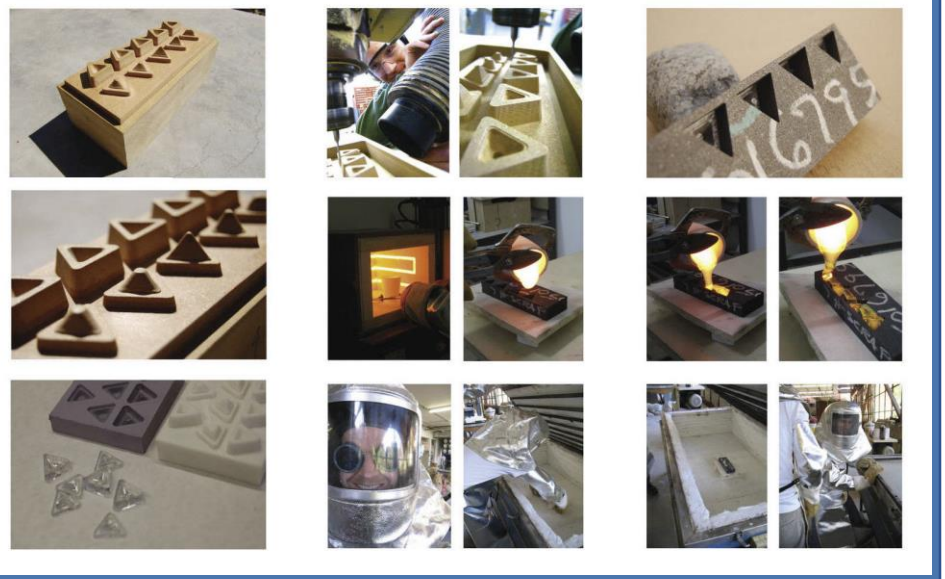
When the tiles are assembled, incoming sunlight produces a “wall of light” being refracted thru glass apertures located at the base of the containers. This is a great example of using RhinoCAM creatively during the design process.





Light Container Fabrication. Designer: Ben McDonald, RhinoCAM CNC Toolpaths were used to Machine the Slip-Cast Ceramic master molds in a variety of materials.

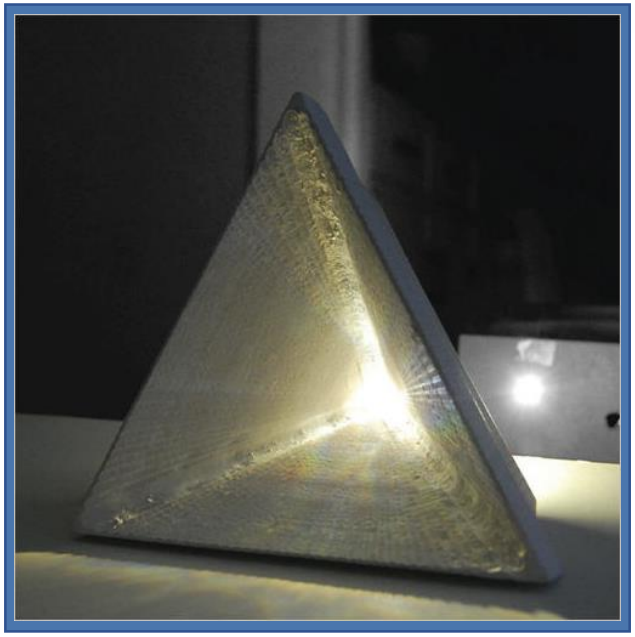
In the images below we see the mold designs and processes used to manufacture the glass apertures that are located at the base of each light container. Here we see CNC machined prototype molds, rubber molds being pulled from the prototypes and then glass being poured into graphite molds. The use of CNC allows for many design iterations molded in plastic that you see in the bottom left images. The pouring of glass prototype apertures are shown in the middle and right side images. The Light Container design and fabrication shown here was a year and a half process for student Ben McDonald.

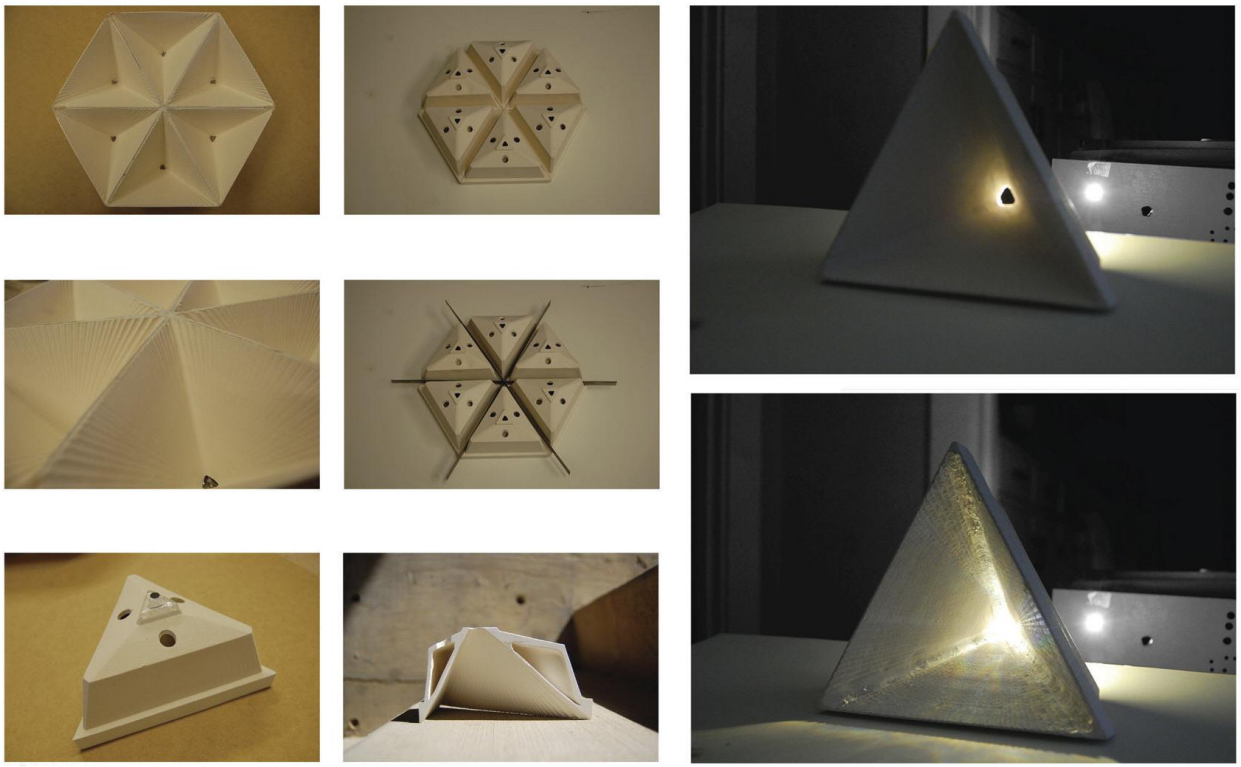


Light Container Fabrication, Designer: Ben McDonald, RhinoCAM CNC Toolpaths were used to Machine the Slip-Cast Ceramic master molds.

Here we see actual light testing on the right below and slip-cased ceramics that were fired to produce the final light containers shown on the left. All of the prototype designs were modeled in Rhino and all toolpaths and cut material simulations were done in RhinoCAM to see what the designs would look like even before starting the prototyping process.

All of the light distribution you see being achieved in the lower right image below is the result of a small glass aperture and a slip-cast ceramic light container. The milled grooves in the light container as well as the mold to produce the apertures were machined using RhinoCAM toolpaths. The light containers were assembled to form a wall distributing sunlight in a rainbow of colors as the sun changed directions during the day!





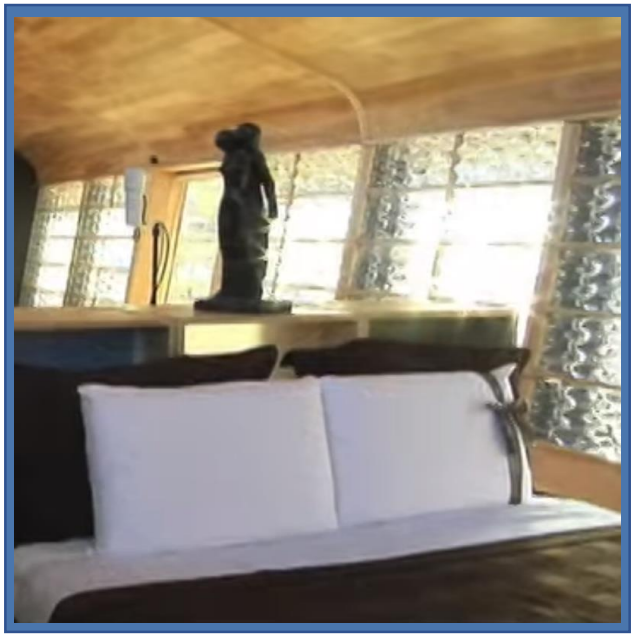
Light Container Fabrication. Designer: Ben McDonald, RhinoCAM CNC Toolpaths were used to Machine the Slip-Cast Ceramic master molds and the master molds for the glass apertures.

The Trombe Water Wall

Designer: Eddie Hall

The Trombe Water Wall shown below was designed by Eddie Hall, manufactured at CAPLA and shipped and assembled in Washington DC for the Solar Decathlon competition held by the Department of Energy. This building process is a thermal mass eco-friendly system that uses water as the primary insulation material.

The hydro-containment cells within the walls are vacuum formed from recycled plastic. The advantage of this building design are many. The system is lightweight and can be quickly shipped (empty of water) to the build site, assembled and then filled with water. Using water as the thermal barrier is proven to be several times more efficient than concrete and offers a beautiful interior design affect. The hydro-containment cells can also be extracted from and entered back into the plastic recycle system as a renewable building materials.



Click Here to see Eddie Hall discuss his Trombe Water Wall design (at 2:15).

Eddie applied Rhino and RhinoCAM to design and machine the vacuum form molds used to produce the hydro-containment cells. The image below is the actual building unit assembled in Washington DC. Notice the hydro-containment cells in the outer walls on the right.

"Seed Pod" designed by architecture students at CAPLA and assembled in Washington DC. Notice Eddie Halls' hydro-containment cells in the outer walls on the right.

Eddie Hall's rendition of the Trombe Water Wall design placed on the national mall in Washington DC.

Here is a closeup of one of the the vacuum forms machined from RhinoCAM toolpaths.

Here is another full size view of the vacuum form along with an actual hydro-container produced from recycled plastic.

Here is a view of the actual hydro-containment system being fill with water on location at the national mall in Washington DC.

More about (Name Removed)

"I am a maker and a teacher. It's my pleasure to start with students, some of whom have never picked up a hammer, and guide them over time to develop into people who can make anything they dream of, anything they draw, out of any material."

(Name Removed) holds a Bachelor of Fine Arts Degree in design from Pratt Institute and a Master of Fine Arts degree in Sculpture from Columbia University. He is the founding partner of The Exhibit Guys (design and fabrication of exhibits for science and children's museums). He has designed and built residential and commercial structures in Tucson, New York, Virginia, Maine and Texas. He also taught design, drawing and fabrication at the University of Arizona, Pima College and Parsons School of Design. He has exhibited artwork nationally and internationally and has received Ford Foundation and UA Faculty Development grants.

More about the Material Labs at the University of Arizona

Interested in the Material Labs at the University of Arizona? Here is additional information links about each lab.

- Ceramics Lab
- Concrete Lab
- Digital Lab
- Glass Lab
- Helidon Lab
- Laser Lab
- Machining Lab
- Metal Lab
- Synthetics Lab
- Wood Research Material Lab

More about RhinoCAM

RhinoCAM - MILL is available in five different configurations (Express, Standard, Expert, Professional and Premium). The part shown here was programmed using the Professional configuration. Here are some additional details about each of the available configurations. For the complete features list, visit the RhinoCAM Product Page.

- **RhinoCAM MILL Express**: This is a general purpose program tailored for hobbyists, makers and students. Ideal for getting started with CAM programming. Includes 2 & 3 axis machining methods. Includes ART & NEST modules as well!
- **RhinoCAM MILL Standard**: This configuration includes everything that is in the Express configuration and additional 2-1/2 Axis, 3 Axis & Drilling machining methods.
- **RhinoCAM MILL Expert**: Suitable for 4 Axis rotary machining. Includes the Standard configuration, plus 4 Axis machining strategies, advanced cut material simulation and tool holder collision detection.
- **RhinoCAM MILL Professional**: Ideal for complex 3D machining. Includes the Standard and Expert configuration, plus advanced 3 Axis machining strategies, 5 Axis indexed machining, machine tool simulation, graphical toolpath editing and a host of other features.
- **RhinoCAM MILL Premium**: Tailored for complex 3D machining with both 3 Axis and full 5 Axis methods. Includes the Standard, Expert and Professional configurations, plus 5 Axis simultaneous machining strategies.

More about Shopsabre

To learn more about the great team at Shopsabre and their line of CNC routers, we invite you to visit them online at their website, Facebook, Google+, Instagram pages and YouTube channel.