

Hot New Boot Fit System Wows Hikers

by Frank Woll, Industrial Design Artist, Lunart

Fast fit

Hikers have always clamored for shoes that fit better. To meet this demand with a revolutionary fit, Montrail's design team developed the IntegraFit™ concept. Because of the accuracy needed, a completely new design and manufacturing process was required. With only **one month** until a big sporting goods trade show in Atlanta, the challenge seemed overwhelming.

Accuracy and freedom

Central to the IntegraFit system were highly accurate custom lasts. (*A last is a form shaped like a human foot.*) The measurements for these lasts came from digitally scanning over a million feet. The traditional method of shoe design and manufacturing did not allow the precision needed to deliver the IntegraFit concept.

Montrail needed a tool that could fit the shoe design accurately to the last and provide creative freedom to the design team.

Since I had experience with **Rhinoceros**, I felt it could deliver the accuracy and freedom Montrail's design team needed. I suggested that they base the new process on **Rhino**.

In less time

Not only was the traditional design and manufacturing process inaccurate, it took many revisions and prototypes to complete a design. We did not have the time to create many prototypes—we had to get it right the first time to hit our show deadline.

What we needed was a way to prototype the shoe on the computer and communicate that complete model to the manufacturers.

We came to rely on **Rhino's** ability to communicate its model in many different ways. We imported scanned data from the last and designers' drawings. We also used files exported from **Rhino** for prototyping and manufacturing and to create graphics for product literature.

Starting with great information

To get started, we needed to represent the physical last in the computer so that we could model the shoe around it. To do this we used the MicroScribe 3-D digitizing arm and **Rhino**.

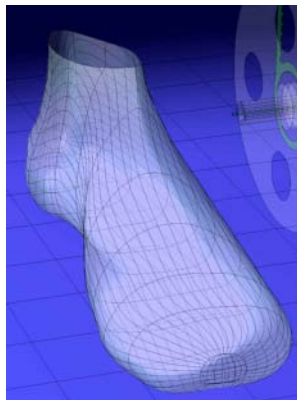
Using **Rhino's** command for digitizing planar section curves from the digitizing arm, we quickly created clean curves without the pre-planning associated with normal digitizing schemes. From those curves, we were able to accurately re-create the last electronically in **Rhino**.

Building an accurate concept model

Montrail's designers handed me a set of paper sketches of the sole and profile of the shoe. They were not to scale, but they represented the shapes they were looking for.

To use them as base drawings, I scanned the sketches and read them into **Rhino** as backgrounds. I was able to capture all aspects of the designer's intent while working out the 3-D surfaces.

To ensure an accurate fit to the last shape, I offset curves from the electronic last and swept a surface through them.



The Project

An innovative line of outdoor footwear created by combining a digital database of scanned foot dimensions with biomechanical research to create the ideal fit.

The Company

Montrail is a Seattle-based manufacturer of innovative, light weight, high performance outdoor footwear for outdoor enthusiasts.

The Team

The main members of the design team were:

Scott Tucker – VP Products
David Schultz – Shoe designer
Frank Woll – Computer modeler

The Software

Rhino for 3-D modeling
Adobe Photoshop for 2-D illustration

The Hardware

Pentium 233 with Windows NT
MicroScribe 3-D digitizing arm
Ciba Geigy Cibatool SL5170 rapid prototyping machine

For more information visit:

www.rhino3d.com
www.montrail.com

Design review

I presented the concept models to the team using **Rhino's** rendering capabilities. The team was surprised at the complex surfaces **Rhino** could create. In some cases, these surfaces were beyond even what they had imagined. Many of those newly discovered surfaces were used in the final design.

Finalizing the design

Taking the feedback I received from the design review, I modified the model. Montrail had some very specific requirements for the measurements and the relationships between the medial last indicator, lateral last indicator, and the arch surface. I was able to modify the design to fit within these specifications.



The great part about **Rhino** is that once I modified these lines, I was able to redefine all the surfaces from the initial curves, ensuring a perfect fit between parts.

Beyond virtual reality – physical reality



For the final review of the design, we wanted a physical model of the shoe. To get a 3-D epoxy prototype, I used **Rhino's** STL file export to provide an accurate, watertight solid to the prototyping service bureau, Plynetics, in Beaverton, Oregon.

In just a few days, we had the epoxy prototype back and the design approved.



Making it real

Even though the final design had been approved, the work was not done. We now had to get the shoe manufactured. Since the prototype parts were all made of the same epoxy material, they fit together perfectly. Since the various layers of the shoe would be manufactured in different materials—nylon, dual-density polyurethane, and carbon rubber—I had to modify the model again to compensate for the different shrinkage rates that occur during the manufacturing process. Each part had to be modeled so that fit tolerances required by the IntegraFit system would hold after shrinkage.

To determine the required changes, the approved design model was sent in IGES format to the manufacturing team for analysis.

They gave us a list of needed modifications for each part based on the various materials. In **Rhino**, the models were easy to scale and modify. We were now ready for production.

Seeing the real thing

In a couple of weeks, we had the first production prototype. The fit between the parts and the fit on the foot was perfect. Based on the prototype, Montrail decided to make a few small design changes. It was quick to make these changes and send the model back to manufacturing for the final production prototype.



The final production prototypes were approved and production started.

Getting ready to show

While the shoe was being built, we started preparing for the show in Atlanta. I made renderings using **Rhino** that I then took into Photoshop for final layout of the advertising literature. I also used the same renderings to print art for the walls of the show booth.

Model reused to create a series of shoes

Since the introduction of the initial IntegraFit shoe, we have created three other models based on this process. We were able to re-use much of the information from one design to the next.

The customer was the true test

The high level of accuracy in the design process can be seen in these comments:

"IntegraFit truly was a different fit right out of the box. Most of our customers who tried it on found it fit comfortably immediately."

Teague Hatfield, Footzone, Bend, Oregon.

"All the new IntegraFit models will have that close-but-comfortable fit. That's exactly what the technology allowed us to do—take out unnecessary space—because we really knew how to fit the majority of all feet."

Menno van Wyk, Montrail President and CEO.

For more information contact:

Robert McNeel & Associates
3670 Woodland Park Ave N
Seattle, WA 98103 USA
Phone: (206) 545-7000
Fax: (206) 545-7321
www.rhino3d.com


CIM Concept, S.A. de de C.V.
Sor Juna Inés de la Cruz 18-206
Tlanepantla, México
Tel.: 52(55) - 55-65-66-33
Fax.: 52(55) - 55-65-67-63
www.cimco.com.mx