



Mastercam Helps Gibson Guitars Stay Legendary



Gibson Guitar develops and builds unique quality instruments by blending old-world handcraft techniques with advanced manufacturing technology. Gibson guitars were quickly established as the best instruments out there.

The Challenge

Gibson Guitars needed a method of machining dangerous repetitive operations with great accuracy,

The Solution [Mastercam Router](#)

Benefits

- Mastercam helped them improve their tooling and efficiency with their CNC routers.



- They were able to achieve greater consistency with far less errors.
- Mastercam allowed for greater flexibility with precise programming.

Project Details

Over the years, with many guitar greats such as Eric Clapton, B.B. King, Chet Atkins, Chuck Berry, and Les Paul playing their instruments, Gibson Guitars developed a legendary status. But its new instruments also must live up to this status. To do this, Gibson develops and builds unique quality instruments by blending old-world handcraft techniques with advanced manufacturing technology.

Gibson's History

Born in Chateagay, New York in 1856, Orville Gibson worked as a shoe clerk in Kalamazoo, MI. But his great love for woodworking and a passion for music got him interested in guitar and mandolin design. His research convinced him that the best vibrating characteristics were found in solid, unbent, unstressed, carved wood. Applying violin construction techniques, and inventing some new ones, his new mandolins and guitars had carved tops and backs instead of flat ones. They became an instant success when introduced in 1894.

When orders began coming in faster than they could be filled, Orville was finally persuaded to set up a company to manufacture instruments. The Gibson Mandolin - Guitar Co., Ltd was incorporated on October 11, 1902 with Orville Gibson as a consultant, but not as a manager since he had no interest in running the day-to-day operations.

The next 15 years were the heyday of the mandolin orchestra and Gibsons were quickly established as the best instruments out there. Because Kalamazoo was located in the "furniture belt" of Western Michigan, the company had access to the best woodworking machinery available and a pool of exceptionally talented woodworkers.

Orville believed that handwork and manufacturing could produce large numbers of high-quality instruments. Two basic policies were established at Gibson that are followed to this day; buy or invent machines for dangerous or repetitive operations requiring great accuracy, and employ a highly skilled worker when the human touch or the musician's ear is needed. This unique combination of man and machine is one of the main reasons Gibson has become a legend among guitar players.

The 1960's were a period of incredible growth for the music business and Gibson. An explosion of rock and roll, jazz, and folk music produced unprecedented demand for guitars of all types. Major guitar makers began to experiment with new materials,



designs, and production changes to speed production and improve profits. A company called CMI bought Gibson, and was later acquired by Norlin Industries in 1969. In 1975, Gibson opened a new factory in Nashville, Tennessee. In 1986, Gibson was bought by a team headed by Henry Juskiewicz and David Berryman.

Instrument Construction

One way that Gibson keeps quality high for its instruments and increases production is through the use of CAD/CAM software. Kenny Tucker, manufacturing engineer from Gibson Guitar Company said, "We have six CNC wood routers in the Nashville plant. We do a lot of our component parts for the instrument bodies that are routed out on this equipment." To make sure that the routers are precise, Gibson uses Mastercam CAD/CAM software (CNC Software, Inc., Tolland, CT) to program them.

Tucker added, "I've spent 25 years in the metal-cutting industry and became familiar with Mastercam there. Gibson hired me to help them improve their tooling and efficiency with their CNC routers. I came to them about three years ago and started pushing them to go to something better than the other software packages they had at the time. Also, we're developing a 3D library of our instrument parts. We have a scanner on one of our CNC routers to scan the parts. This information is then downloaded into Mastercam to develop a 3D model. This 3D scanning also helps us with programming the unique carved surfaces for many of our instruments."

Since Tucker was responsible for manufacturing, he wanted software that he was comfortable with. Furthermore, he didn't like some of the limitations he had noticed with the other software packages.

He added, "Mastercam really gave us a lot more features and flexibility for precise programming. With this software, if I wanted to move something in a specific dimension, I could put it exactly where I needed it. For example, the contour on the top of our Les Paul electric guitar is intricately carved and has a history to it. We scanned one that was done by hand and brought the scan into Mastercam. We wanted to develop a drawing to make sure that the pitch of the neck was just right. If I wanted to move it two degrees, I could pick a point and rotate it around that point two degrees, and it would go exactly where I wanted it to. With the software, we were moving things as much as five-and six-thousandths of an inch to get guitar components where we wanted them to be. When they came off the CNC, they were perfect. Parts come out more consistent with far less chance for errors."

Tucker said their routers can hold a tolerance of plus or minus one-thousandths of an inch or even better. "Of course, working with wood you've got its variability that we have to take into account, but if we try to get it as close as we can from the routers, then it just



makes everything easier down the line,” he remarked. One of their CNC routers is a brand new Northwood that has four heads on it and two 5 x 10 foot tables.

To duplicate the same profile and contour of Gibson’s classic Les Paul carved-top electric guitar, Tucker said they took a body of an older one, scanned it, and duplicated the surface with their new router. Then they took those scanned points and made a 3D rendering of the surface. Using a six-inch ball-nose endmill on the CNC router, they carved the top of their new Les Pauls and got them as close as possible before they’re finished by hand using a sanding machine.

“With the help of Mastercam, we get the guitar tops carved as closely as possible, then we turn them over to the artists, which are the hand sanders and the craftsmen. Now the guitars have less variance than before, and the craftsmen can work their magic at this point with much less effort,” mentioned Tucker.

Tucker says that he feels there are a lot more challenges with guitars than in the metal cutting industry. “With the curves and contours and the artistic characteristics that we try to do with these instruments, sometimes producing them is a real challenge.”

“One of the things with Gibson is that their guitars are often historical pieces. You can’t just come in and change something, because the artists that are out there playing them would find it in a heartbeat. So, you have to try and maintain the curves and feel of the guitar and the necks. Because players can just pick up a guitar, and look at it, and see that something’s been changed,” explained Tucker.

Mastercam is used for solid bodies, hollow bodies, and even acoustic guitars and mandolins. They also use it to develop the fixtures and tooling used for producing the instruments.

A software feature that Tucker uses often is its verification ability. After a part is programmed, he can run the program in real time on the computer to see if there are any problems. “For example, on the scarfs that go around the outside of our Gibson SG, I can make sure that what I programmed is coming out close to what I think they should be. If not, I can make some adjustments before I start cutting wood,” he said.

Routers are also used to cut the delicate abalone and pearl inlays for the guitar’s fretboard. On some guitars, this is very elaborate and for others, the pearl is just used as fret markers. Tucker remarked, “We use Mastercam to program the fretboard pockets for the inlays, and to program the cuts for the inlays themselves that go in those pockets.”

Between the pearl and pocket, the tolerance for the fit can easily be five thousandths of an inch or less. With a pocket that’s too large, the aesthetics of the pearl can easily be lost



and the fretboard scrapped. “We try to have a really tight fit, because again, that’s an aesthetic thing that’s part of the Gibson history - it looks good and plays well. You have to keep those things close in order to maintain that integrity,” added Tucker.

Along with guitar building, Tucker uses Mastercam to design and build special machines for production at their in-house metalworking/machine shop. George Mathews, the machine shop lead man, also uses Mastercam to program a 4040 Fadal Machining center and the CNC routers to make fixtures and prototype parts.

As a major player in today’s instrument market, Gibson must hold onto the tradition of building quality handcrafted instruments, but be able to produce them at a competitive cost. Even though some of its other instrument brands are produced off-shore, many of the most sought after ones, such as the Gibson guitar, are American made. Today Gibson owns the Epiphone, Valley Arts, Kramer, Steinberger, and Tobias brand of guitars along with Baldwin Pianos and Slingerland Drums. It also produces several lines of instrument amplifiers.