Innovations in Bass Making and a Playing Demonstration

JIM HAM
1755 Taylor St., Victoria, BC, V8R 3E8 Canada
jamespeterham@shaw.ca

and

CRAIG BUTTERFIELD
School of Music, University of South Carolina, 813 Assembly St., Columbia, SC 29208
cbutterfield@mozart.sc.edu

Saturday, November 12, 2005, 2:30 pm

Fan Tao: Many years ago, before I got into this acoustics business, Gary Karr made a presentation at a VSA convention in which he talked about a bass by Jim Ham. So now we have an opportunity for Jim himself to discuss his bass and some of his ideas for the future of basses. As you can see, he’s working from the bottom up. He started with basses, and he’s now worked up to cellos. So maybe some day he will be making violins, I hope.

Jim Ham: I’m very grateful to the VSA for embracing the subject of innovation in the violin world and inviting me to speak about innovation and the double bass. There’s an ad running in Strings magazine touting the traditional way the advertiser’s instruments are made with the slogan, “Nothing new to report.” Well, today we do have something new to report! I’m going to start talking about innovation in double basses because that was the original subject of this talk, and then I’ll move on to my ultra-light cello project.

I got interested in making instruments as a result of my repair work over the years. I kept noticing the same problems that seemed to me could be prevented by re-engineering some aspects of the traditional design. As an example, consider the ribs of this Carcassi bass that shows many cracks radiating away from the corner block (Fig. 1). It’s obvious that the cracks occurred because the wood of the ribs was glued at right angles to the wood of the corner blocks. Because the wood shrinks in the radial direction much more than in the longitudinal direction, the blocks restrain the ribs from shrinking as they dry, and cracks are the result.

This is my solution to this rib problem (Fig. 2). What you’re looking at is a vacuum pump hooked up to the three forms that make the ribs of my bass. I make my ribs by vacuum laminating two layers of maple with a layer of silk cloth in between. This allows me to get them accurately shaped, and I make sure that they are as dry as possible before gluing them to the blocks. The silk acts as an internal reinforcement against cracking. Some people react with horror to the idea of lamination, but I must point out that most antique instruments have been extensively retrofitted with laminations in the form of cleats and patches when the cracks were repaired. I would rather prevent the cracks from occurring in the first place. I’ll come back to this subject when I get to the ultra-light cello project.

In 1994 Gary Karr, a customer of mine for a long time, was kind enough to commission a bass from me, which I completed in 1995. Here is a picture of Gary and me with that bass (Fig. 3) taken in Osaka, Japan in 2001, where he performed the solo of the Dvořák Cello Concerto!
Figure 1. Ribs of a Carcassi bass with many cracks.

Figure 2. Vacuum pump hooked up to three forms that make ribs for basses.
Figure 3. Jim Ham (r.) with bass he made for Gary Karr (l.).

Figure 4. Jim Ham’s adjustable bass neck.
Probably the innovation for which I'm best known is the adjustable neck (Fig. 4). Because the bass is so large, the seasonal shrinking and swelling of the top and back with changing humidity causes large changes in the string clearance over the fingerboard. Also, the size of the instrument magnifies the difficulties of fingering that result. The most common solution to this problem is the adjustable bridge. As we know, the bridge is a critical element in tone production, and I think that the adjustable bridge causes a loss in tone quality. Also, Gary Karr says that the adjustable bridge interferes with his ability to feel what the instrument is doing through the bow. Consequently, he used to travel the world with several bridges of different heights in order to be ready for the local climate. My adjustable neck moves the adjustment function from the most sensitive part of the instrument—the bridge—to the least sensitive part of the instrument—the upper block. The heel of the neck slides against a surface, which is designed to be at exactly a right angle to the string in normal position. The result is that when the neck moves when adjusted by the inserted key, there is a negligible change in string length and, consequently, a negligible change in pitch.

The after-length (distance between tailpiece saddle and bridge) is also an important factor in the instrument’s set up, especially when dealing with wolf notes. I make my tailpieces with movable saddles to adjust the after-length for this reason (Fig. 5).

I’ve noticed that the antique basses whose tone I preferred most often had flat backs. However, the flat-back design inevitably results in cracking for the same reason that the ribs always crack: the braces restrain the back from shrinking. My answer to this problem is to make a round back with very low arching so that it approximates the flexibility of the flat back and provides the extra stiffness needed where the soundpost contacts the back with a carved-in brace, as seen here (Fig. 6). Also visible in this photo is the glue that will attach the back to the rib garland. I’ll say more about that in a moment.

The next photograph (Fig. 7) shows the rib garland for that bass, which is the same one that Craig will be playing here today. Here is the upper block of that bass with the glue already on it and dry (Fig. 8); you can also see the T-shaped slot, which is provided for the neck-sliding mechanism. In this next picture (Fig. 9) I’m shooting steam into the glue joint. I brush glue onto the mating surfaces and let it completely dry before clamping the parts together. This gives me all the time I want to get things lined up and fitting just right. Then when I hit it with the steam, the glue is reactivated and sticks together perfectly! In this picture I’m steaming the top joint (Fig 10).

The innovation I am most proud of is the ergonomic bass shape. Bass playing is extremely difficult, so anything the maker can do to make it easier and more comfortable to play is something players will welcome. Here are some pictures of the complete bass (Figs. 11-14). I make my own tuning machines and I have carved the scroll with enough clearance to allow the low-C extension to be fitted with the string passing over the scroll, rather than through it on its return to the peg. The extension is my design also and allows each note to be adjusted. Here are some pictures of my violin-cornered bass (Figs. 15-17).

I’m certainly not the only one trying to apply new ideas to the double bass. There are a couple other makers I admire. One is Patrick Charton, who has won gold medals for his traditional model basses in VSA competitions. He is shown here (Fig. 18) with his B21 model bass for the 21st century. Figure 19 shows his solution to the challenge of creating an adjustable neck. It is a totally different approach than mine but also works very well. The neck can be removed and the bass goes into these two cases for airline travel (Fig. 20). This is me with Patrick’s B21 (Fig. 21). As you can see, he has redesigned the appearance of the bass to completely eliminate any element of Baroque design. Patrick’s design reminds me of the beautiful design work of Guy Rabut. In addition to Patrick Charton and me, the next photo (Fig. 22) includes Arnold Schnitzer with his solution to a bass with an ergonomic shape and modern-looking design. Arnold is here today.

Before I move on to the ultra-light cello, I would like to give credit to a few people who have been inspirational to me and who have been fellow participants in the VSA/Oberlin Acoustics Workshops. Each summer makers, scientists, and engineers meet to try to understand how instruments work to produce sound
Figure 5. Jim Ham's tailpiece with movable saddles.

Figure 6. Round back with very low arches.
Figure 7. Rib garland for bass.

Figure 8. Upper block of bass.
Figure 9. Shooting steam into a glue joint.

Figure 10. Steaming the top joint.
Figure 18. Patrick Charton with his B21 bass model.

Figure 19. Charton’s adjustable neck.
Figure 20. Patrick Charton’s bass with removable neck and travel cases.

Figure 21. Jim Ham with Patrick Charton’s Model B21 bass.
Figure 22. (L.-r.) Arnold Schnitzer, Patrick Charton, and Jim Ham.

Figure 23. Joseph Curtin and Doug Martin hold balsa wood violins.
and how we may be able to make them work better in the future.

Joseph Curtin certainly has nothing to prove to the traditional violin world about making conventional violins—he can do that as well as anybody on earth. But he’s decided, as has Patrick Charton, that we need to venture from the comfort zone of tradition and move on into the future. This next photo (Fig. 23) shows Joseph with Doug Martin, who didn’t know all of the things that tradition dictates must or must not be done to make a good-sounding violin. Doug has been uninhibited in trying things like the balsa wood violins seen here, whose amazing sound has caused Joseph and me, among others, to reevaluate our ideas about how to make great-sounding instruments. Here is Doug Martin with the balsa wood violin you heard this morning (Fig. 24).

One of my heroes is Norman Pickering. He’s casting a critical eye on my bass there, and my wife Miriam Chong is playing it (Fig. 25). Here is Norman with Ted White (Fig. 26), my partner in the ultra-light cello project, talking about acoustic materials testing. We’re working all the time to learn more about the properties of the materials that make instruments. I think Ted’s going to be adding an awful lot more to that science in the near future.

And here is another one of my heroes, Oliver Rodgers (Fig. 27), one of the pioneers of the Catgut Acoustical Society, who has contributed so much to the science of violin acoustics. If you haven’t been reading in the Catgut Journals and other places about the work that Norman and Oliver have been doing, you should.

This is the scroll for the ultra-light cello (Fig. 28) and the scroll of an English treble viol made in 1609 by John Hoskin, which is in the National Music Museum (Fig. 29). Some “new” ideas are 400 years old! That’s making the scroll (Figs. 30-32). If you saw the scroll this morning, this is how I did it (Fig. 30). Here I used a haircurling iron to bend the veneer. In this (Fig. 31) I’m using radiator hose clamps and closed-cell foam to clamp the veneers together. Here I’m test fitting the scroll to the pegbox (Fig. 32). This is the carbon fiber reinforcement inside the neck (Fig. 33). Here I’m gluing the carbon fiber tube into the long part of the neck (Fig. 34). Now we’re making the ribs (Fig. 35). You can see the form and the vacuum pump. The rib consists of a layer of balsa wood between two ½-mm-thick layers of maple veneer. Here the laminated rib sits in a groove that was cut on a CNC machine, a lot like what Raymond Schryer did with his Guit-Fiddle that appeared in his recent (October 2005) article in The Strad (Fig. 36).

We’re gluing the linings in here (Fig. 37). We again used the CNC machine to help us to very accurately make the shape of the outline. That’s the complete rib garland, with the exception of the upper block (Fig. 38), and the next photo (Fig. 39) shows the neck attached.

Now we’re making the front (Figs. 40-44). The front of the cello is made out of three pieces of balsa wood surrounded by a plywood perimeter, and formed in this classical Italian arch over a construction form. On the top there is a central plank of balsa wood with the grain going lengthwise, while the side planks go across grain to take advantage of the fact that, on that part of the top, the material is loaded in compression.

This is the back under construction (Fig. 45). The back has the grain going lengthwise. Here’s Ted with the top and the back (Fig. 46). They don’t look very different when the top is without the f-holes, but you see the grain direction.

There are two bars in the top (Fig. 47): a traditional bassbar plus what we’ll call a treblebar. The bassbar was shaped in the traditional way. The treblebar is much smaller. You can’t see it in this picture, but it’s less than a third the height of the bassbar and has a platform for the soundpost and has f-holes now.

Here’s a good view of the back, showing its bass treblebar (Fig. 48)! The bar is made out of maple and has a platform for the soundpost to land on. Guess how we glued the front and back on? You’ve already learned about that now (Fig. 49). There’s another mad scientist at work (Fig. 50)!

This is the attachment of the heel of the neck to the body (Fig. 51). You may have seen that adjustable neck somewhere. I’ve got a few glitches to work out. That’s why I didn’t get it right today, but basically that’s the fixture that holds the neck in place.

We need to stop on the label (Fig. 52). I’ll translate the label for you: **Albus balsius perna in Victoria. Albus, anybody? It’s White, that’s Ted. Balsius is our sacred wood. Perna, well, that’s**
Ham. Victoria is where we live. Faciebat anno: that’s not Stradivari’s divorced wife, but “made in” the year 2005. Sub titulo D. Martinus: we’ve paid homage to Doug Martin, who showed us that balsa wood could be used to make great sounding instruments. And Sine Sientia Ars Nihil Est: “Without science, art is nothing.” And I think we should end it there.

Now Craig Butterfield is going to play on my bass and talk about what the instrument means to him. Craig is a professor of music at the University of South Carolina in Columbia. He’s a fantastic bass player. His repertoire ranges from Bach and Schumann to Jaco Pastorius and Edgar Meyer. I don’t know what he is going to play today, I’m just going to leave it to Craig (Fig. 53).

Craig Butterfield: I have to say that I agree 100% with what Jim was saying. My degrees in music are all in classical performance. Going through school I noticed something interesting: there are more and more people out there competing for fewer and fewer jobs. So if you do the math, you find out that jobs are very difficult to get in the classical orchestra world today.

So what I tried to do with my own playing was to branch out into as many different areas as I could. I’m always looking at different kinds of music and seeing what inspiration I can draw and how I can contribute, and how that music can contribute to my own playing.

Here’s an example of my recent schedule of performances of different styles of music. This past summer I was touring Europe with jazz trumpet player Maynard Ferguson. When I got back to the U.S., I had about a two-day turn-around before I had to play Schubert’s Trout Quintet in about seven or eight performances, and then a few weeks after that, I had a short solo-based recital tour. I was playing everything from Bach to Piazzolla, and basically trying to run the whole gamut.

That’s where I come from as a player. So when I was looking for an instrument, I commissioned Jim to make this bass for me about two years ago. There were a few things I was looking for, and side-by-side with beauty and strength of tone, I wanted versatility. Could I find an instrument that would be there with me no matter what kind of music I was playing, whether it was playing in an orchestra or playing a solo recital or playing Schubert’s Trout Quintet in a chamber group?

One specific way this instrument helps me to do that is the adjustable neck Jim was talking about. Orchestra playing requires very vertical bow strokes. You’re always slamming down on the strings from above, and so the string height has to be much higher than if you’re playing chamber music or solo music. The ability to change the string height on the fly and not have to retune the instrument was hugely important to me because, as Jim mentioned, the direction of adjustment is perpendicular to the direction of the strings. So the deflection in pitch is extremely minimal, and I can adjust the string height from almost touching the fingerboard to higher than I’ll ever need it, and I don’t have to retune, maybe only touch up a tiny bit. So that’s been very useful in recitals where I may be playing a piece of music, maybe some solo Bach, where the strings can be very low; I don’t have to dig in much with the bow. And then the next piece, maybe I’m playing a sonata or concerto, trying to fight to be heard over a piano, where I need to generate more string energy with the bow. Being able to change string height on the fly like that has been a lifesaver.

The other main thing that has really helped me is that the shoulders of this instrument are cut a little bit lower than on the standard double bass—and even more important than that is the bevel that occurs at the top of the back. That enables me to reach down and grab onto the bridge if I want to. On most basses it’s a struggle to get into the upper register. With this instrument, it’s right here. Nothing is a struggle; it’s very easy to move around.

It is important to me to have the whole register of the bass available at any time. I can go from down low to up high just moving my arm. I don’t have to sit up higher on my chair or stand. Sometimes people stand because they can get around, they can get over the instrument. Another huge factor for me is that the bevel at the top brings the instrument a little bit closer in to you. That is overlooked a lot in basses. I’ve seen a lot of basses with small shoulders that are extremely deep up here at the neck block, and that does not help. It makes it just as hard to get around as it is playing a bass with high
Figure 24. Doug Martin with one of his balsa wood violins.

Figure 25. Norman Pickering listens to Miriam Chong play Ham’s bass.
Figure 26. Norman Pickering and Ted White.

Figure 27. Oliver Rodgers.
Figure 28. Scroll of Ham-White ultra-light cello.

Figure 29. Scroll of a treble viol made by John Hoskin, England, 1609.
Figure 30. Making a scroll.

Figure 31. Hair-curling iron bends the veneer.
Figure 32. Radiator hose and closed-cell foam clamp veneer together.

Figure 33. Carbon fiber reinforcement inside neck.
Figure 34. Gluing carbon fiber tube into long part of the neck.

Figure 35. Making the ribs.
Figure 36. Laminated rib sits in a groove cut on a CNC machine.

Figure 37. Gluing the linings.
Figure 38. Complete rib garland without upper block.

Figure 39. Rib garland with neck attached.
Figures 40-44. Making the top plate of the ultra-light cello.

Figure 41.
Figure 42.

Figure 43.
Figure 44.

Figure 45. Back under construction.
Figure 46. Ted White with top and back.

Figure 47. Bassbar and treblebar with soundpost platform on the top plate of the ultra-light cello.
Figure 48. The back with bass treblebar of the ultra-light cello.

Figure 49. Gluing on front and back using steam.
Figure 50. Ted White at work.

Figure 51. Heel of neck showing attachment mechanism.
shoulders. So the importance of the bevel can be overlooked in ease of play.

I know we’re very short on time, so I’ll play one short selection. This is something that illustrates what I think this bass does very well. This piece draws a lot more on folk music and blues, probably, than on classical style, but the availability of the whole fingerboard is key to something like this. [Mr. Butterfield plays Mr. Ham’s bass for the audience (Fig. 53).]

Mr. Tao: Thank you, Craig, and all of our presenters this afternoon.