Extreme Flute Tone Hole Repair  
By Brian Russell

This article will describe a technique for replacing the rim of a ‘drawn and rolled’ tone hole that has sustained severe damage. In the process, the tone hole is straightened (if necessary), the old rim is removed, a new rim is formed from Sterling silver sheet (spun on a metal lathe), soldered in place and dressed to finish. The tools and supplies are not terribly expensive and the process does not present great difficulty. But, this is ‘major surgery’ that is not taken lightly. The result is a permanent repair that is mechanically, aesthetically and acoustically sound. I have chosen to define these terms as follows:

**Mechanically sound means:** The tone hole rim is at least as physically strong as the one it replaces. The joint of the grafted part to the body has an acceptable life expectancy. The repaired tone hole is at least as repairable as it was when new. The surface will allow for precise pad seating. The materials do not interact badly with other materials they are likely to contact.

**Aesthetically sound means:** There is very little difference cosmetically between the repaired tone hole and the tone hole before the damage occurred.

**Acoustically sound means:** There is little to no change in the acoustical response of the instrument due to the repair.

**Tooling requirements:** Metal lathe, Shim Punch, tool rest (fabricated), Burnisher (fabricated), Caliper, Scraper, flat reference surface, facing tools

**Material requirements:** Sterling sheet (.016”), 96/4 tin/silver solder, ¾” Brass Rod (or other suitable material for the mandrel). As an alternative to purchasing the shim punch, you can contact the author to purchase pre-punched blanks.

**The setup:** A tool rest similar in function to one found on a wood lathe is used to support the burnisher. The top of the tool rest should be fairly close to the center height of the lathe. The burnisher is fabricated from ¼ drill rod. The tip is turned to a ‘bullet nose’ and polished. It can be inserted into a handle, or simply held in a drill chuck.

( Burnisher )
The Process:
Document the existing tone hole dimensions. (Height, Rim OD, Hole ID) Depending on the damage to the hole, measurements from another hole on the instrument may provide useful indications of the maker’s intent. Altering these dimensions will affect the tuning of the instrument.

Straighten body and remove dents affecting the area around the tone hole(s)

File to remove the damaged rim, being careful to preserve the orientation of the plane of the rim.

Measure the outside diameter of the tone hole ‘chimney’. Don’t be surprised if it is not exactly the same longitudinally and laterally.

Turn a mandrel to the outside diameter of the tone hole. (The larger of the measurements, if there is a discrepancy.) Center drill and bore the end on a 60° included angle, to match a live center. Leave a flat surface on the end of the mandrel about .015" wide.
Punch a silver ‘washer’ of an appropriate size for the damaged tone hole. (3/8”x3/4” for most)

Lubricate the silver washer (Tap-Ease), and press it into the mandrel with a live center in the tailstock ram.
Burnish the washer down on the mandrel. Measure the outside diameter as you go, to duplicate the original.

( Ready for Spinning )

( Spinning )
Trim to the desired height. If it is too high, it will contact the body before coming to rest on the chimney, making the orientation of the planar surface difficult. Variance from the intended height will also cause difficulty in padding, and alter pitch.
Remove the piece from the mandrel (be careful not to bend it).

Solder it to the tone hole with 96/4 solder, from the inside.
Remove the excess material on the inside of the hole with a scraper, then polish the tone hole interior with Tripoli on a cotton swab in a Dremel (or similar) tool.

( Interior Cut Away )

Dress the face, inside edge, and outside edge of the rim. Be cautious of leaving a wide face. The surface area of the seat is inversely proportional to the pressure that the seal will hold, since the closing force of the key remains constant. (Think PSI)

( Repaired Tone Hole )

The tone hole repair is complete. Replace the pad and adjust as necessary.