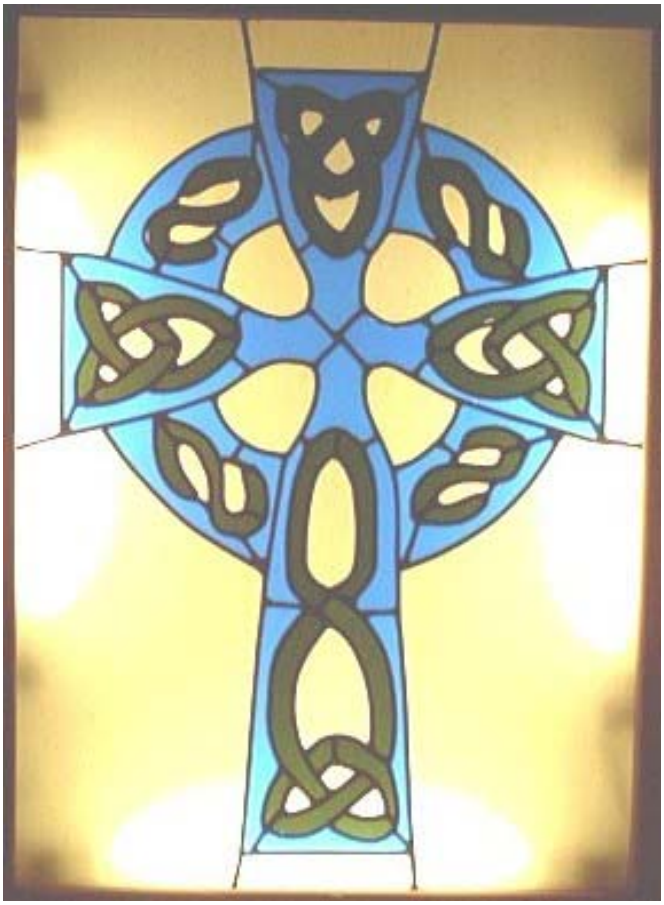
Stained Glass Celtic Cross of St. Columba



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Introduction:

I have been working with stained glass for several years and this project is one of the few pieces that I have made using lead calm or kame. From my research, I find that Celtic knot work was not prevalent in medieval stained glass. I chose the to make the Cross of St. Columba for the mere reason that I liked the pattern and have used it in many other projects, including a tiffany (a copper foil style developed in the 16th century) version of this cross. The cross of St. Columba (appendix 2) dates back to 6th century Scotland, while the construction style that I am using dates back to the techniques outlined by a Benedictine monk by the name of Theophilus in the 12th century (appendix 1).

The topics I will be covering start with how I made the cross. As I discuss my construction techniques I will also explain any deviations from Theophilus's methods, outlined in appendix 1. Next is a brief history of stained glass leading up to the middle ages, and an overview of the methods of Theophilus (appendix 1), followed by an introduction to St. Columba (appendix 2), whose cross this represents, and lastly some background on the origins of the Celtic cross in Celtic Christianity (appendix 3). Any numbers in parentheses represent a reference in my bibliography.

Please note that the display case for this entry is not part of the project itself, but a means to display the cross so that it may be viewed without a window.

Steps in the construction of the stained glass Celtic cross of St Columba :

Even though most of the scenes represented in early medieval glasswork were inspired by the Bible, I chose to do a Celtic cross simply because I liked it. The pattern that I used for the creation of the stained glass piece is the Celtic Cross of St. Columba (appendix 2).

Throughout this portion of the paper, I make many references to Theophilus, and his techniques in creating a stained glass window. For further information on him and his methods, please refer to appendix one sub heading “Theophilus”.

The first picture shows the tools I used. In the back is my grinder for shaping the pieces. Next to that is my soldering iron. In front on the left is a lead cutter, fid for shaping the lead calmes , grozing tool, a piece of the lead, solder, samples of the glass I am using, and last but not least, a cookie for nourishment (photo 1)

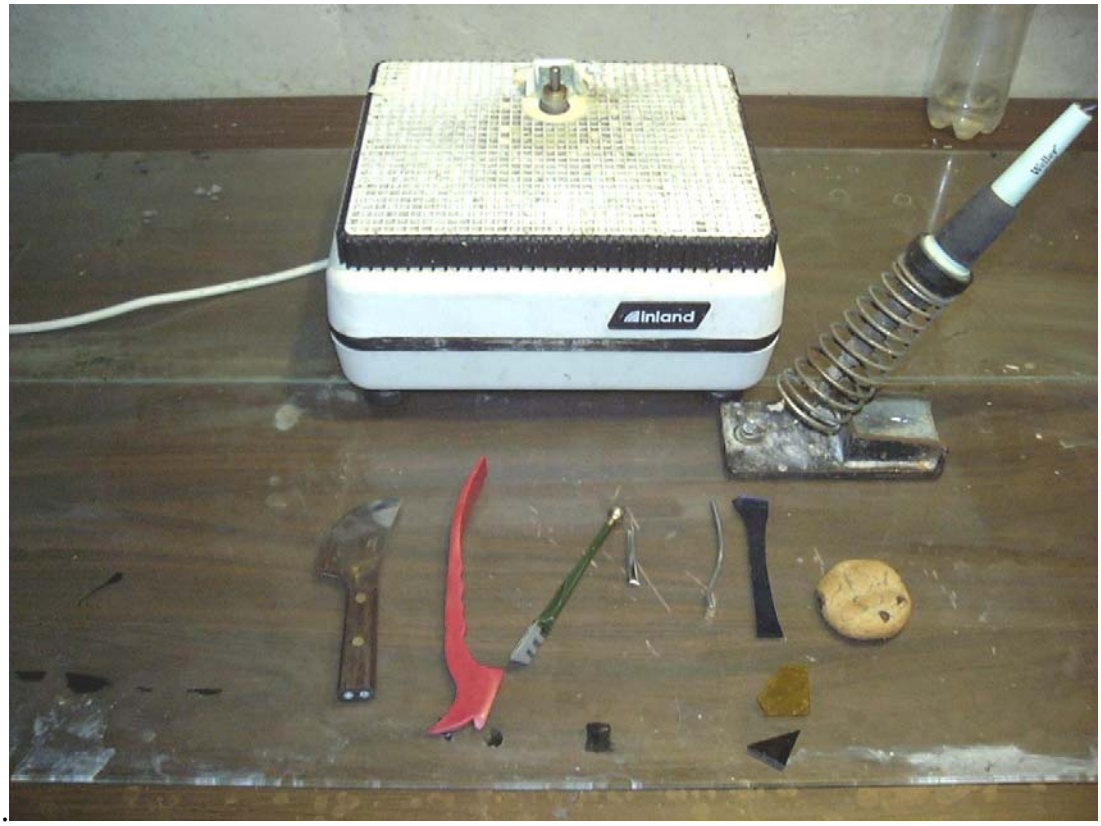

Photo 1

My first step was to print the image of the cross that I had created in my computer based on patterns that I have archived for other projects. The printed pattern was anchored to a piece of wallboard. This setup represents my version of the whitewash board that Theophilus described (photo 2).

Photo 2

I chose to use antique glass for this project. The striations, air bubbles and varying thickness is close to the type of glass that was available in Theophilus's time. The colors, yellow for the background, blue for the cross and green for the knot work were also basic colors that were used in early glass. So off to the glass store I went to buy my glass, lead, and solder. From my studies, it appeared that the glass for the cathedrals was made on site. Although I do have a kiln, due to time, expense, lack of skill, and working environment, I chose to buy my supplies instead of making them.

The next step I took was, like Theophilus, was to lay the glass on the pattern and draw the shape onto the glass. Instead of wet chalk I used a pen (photo 3).

Photo 3

I then veered from his method and cut all the pieces of a second pattern and glued them directly onto the glass of the proper color. Note that each piece of the pattern has a number so that when the second pattern is cut up I can locate it on the main pattern. One of the details that I had to check were there any patterns in the glass itself? I found that the yellow glass has striations going the entire length of the glass. So when I laid out each piece of yellow glass, I had to make sure that the striations were going all in the same direction or in a certain pattern (such as radial from the center of the cross out). If I didn't, the entire piece would have had a random look to it. I chose to have the striations go in a vertical direction. The green and the red did not have any patterns that I could easily see.

I then rough cut each piece. Theophilus used a hot iron rod to create a fissure in the glass then drew the iron along the drawn line to cut the glass. I used a glasscutter (brought into use around the 16th century). For the final shaping and trimming of the glass to make it fit I did use a grozing rod and electric grinder (as opposed to Theophilus's grinding stone).

When it came time to start assembling the pieces of the cross together, Theophilus said to start in the center and work your way out. I veered from this format and started in the upper left hand corner of the piece and began to work out from there. I did this to anchor two sides of the frame to the "whitewash board", creating a more stable environment for holding the glass in place. After each piece of glass was fine tuned to

fit into its designated spot, it was encased in the lead calm and then pinned into place so it would not move.

Instead of using nails, I used pushpins as they held just as well and were easier to position in the wall board (photo 4).

Photo 4

The process I followed was to rough cut a piece of glass, rough shape it, remove the paper pattern from the glass, place the piece over the spot where it is to go, draw a refined image on the glass, grind the piece down to match the pattern then continue to trim it until it fit into place (occasionally starting over with a new piece of glass). Once I was happy with the fit, I wrapped the piece in lead, pinned it down securely and then went onto the next piece. This procedure was used for each piece of the pattern until all the glass was in place. One of the problems that I did run into while placing the glass was, Celtic knot work had interlocking pieces. There were times that I had to remove some glass already cut to place another piece that interlocked. After doing this a few times, I learned to plan my strategy a little better.

The next step was to solder the joints of the lead calmes together. Theophilus called for a hot iron and solder. I used a soldering iron, which for all intents and purposes is the same as an iron rod. I fluxed and melted solder onto each of the joints of cross. Then carefully I turned the piece over and repeated the process to the joints on this side. Because of the size of the cross, ties and tie bars were not necessary as these were supportive mechanisms for much larger pieces.

Once all the soldering was complete, I cleaned the piece to remove dirt, and flux. Because of the size of the cross I did not feel the need to use a whiting to seal the lead. Firstly the cross is small enough to bear its own weight. Secondly besides adding strength to the window, whiting served to waterproof windows that were exposed to the elements. This piece is not intended to be exposed to the elements. The final step was to add a patina, or staining to the lead. The purpose of this was to darken the lead to make it stand out more.

As this cross was not intended to be built into a window and due the lack of window space at the Pentathelon, I decided to have a light box built for the cross (thanks Dad!). Please note that the light box is not part of the intended project but is a means to provide illumination for the cross for this event. The metal frame holding the glass was placed into the wooden frame. To disperse the light, I placed a layer of Velum behind the glass and placed a light source behind the Velum. The frame allows the cross to sit on a table. If desired, the cross can be removed from the light box and hung on chain by loops that can easily be built into the metal frame, for display in a window. If in the middle ages if they did choose to display glass inside with back lighting, they could have easily built a small wooden frame to house the piece, then added tiered shelving behind the frame and placed lit candles on shelves.

I was pretty pleased with the outcome of the project. To me, some of the lead lines could have been better, some of the gaps in the lead joints smaller. One of the other things I discovered (unfortunately after I was done mounting the glass in its display case) was some gaps I did not see during soldering most probably due to lack of color contrast between the glass and lead, and angle of lighting. I believe that the addition of a whiting would have solved this problem. Due to lack of time I cannot fix it but after the competition the modification will be made.

For being just a beginner in this style and given the complexity of the pattern, I am happy with the way the cross came out. It is still not my choice of style for glass as I can’t get the smaller detail (5mm in some of my other projects) in lead as I can use the copper foil method. I did learn quite a bit, though. I learned how to plan for this style of window, refined a lot of my cutting and assembly techniques, and mostly I now have a better understanding what the glaziers in the middle ages went through to create the works that they did. It took me about 60 hours, five or six band-aids, and two pair of socks (holes created by stepping on small bits of glass that find their way to my floor) to put this piece together.

APENDIX 1

A brief history of stained glass up to the middle ages and the writings of Theophilus:

History

Colored glass has its roots as far back as ancient Egypt around 3000 years ago. The Egyptians pressed glass for perfume bottles, beads, and a wide variety of other uses. Glass was preferred over pottery. They discovered that by heating silica (sand, quartz) with potash, the silica could be fused. It wasn't until between 1554 BC and 1075 BC that the Egyptians discovered how to make clear glass. At this point in time they learned that they could cast this new glass into rods and while hot, mold them around sand cores to create vessels. The colors they created were more accidental than design due to the impurities in the materials they used. Color could be somewhat controlled by heating or cooling (1,6).

The blowing iron came into use somewhere in the second century BC. This allowed the artisans to attach a blob of glass to the end of a tube and blow air into it. The glass could be easily shaped by heating, blowing, rotating, and then repeating the process again until the desired shape was achieved (1,6,15).

The Romans had been working with flat glass in the first century AD. They had inserted small pieces of colored glass into mounts for decoration. The Muslims used the flat glass to make mosaics in windows (1,6).

By the first century AD, it was discovered how to make glass transparent and colorless. Color could be controlled by adding certain oxides the (1,6,15,21).

The earliest known pictorial glass was from records dating back to the 9th century. The oldest remnants were of a depiction of Christ's head from the Lorsch Abbey in the Rhineland (France) dated between the 9th and 11th century. Medieval stained glass was not used to pass light but more to capture and reflect it and really didn't take off until the Middle Ages in Paris. The Abbot Suger commissioned the windows for the Abbey Church of St. Denis between 1144 and 1151, starting the stained glass trend. Soon after that windows were commissioned for the Charters, Bouges, and Le Mans cathedrals. Stained glass reached its peak in the middle ages between 1130 and 1330. Popular scenes were Iconic and religious. A popular style is called a rose such as the one commissioned at St Denis. Most rose windows use one of two themes. They are the glorification of Christ and the Virgin, and Christ as the apocalyptic judge. Sources of inspiration of stained glass comes largely from the Bible (1,6).

Theophilus

In a book entitled *De Diveris Atribus,* a 12th century Benedictine Monk by the name of Theophilus, penned what is considered to be the "how to" book for the creation of

stained glass windows. The techniques that he used are really not much different than those employed today (1,6,7,20).

Lets take a look at how the glass was made. Theophilus used two parts wood ash to one part river sand and heated to about 2100 degrees F. This combination came about by trial and error not by quantitative means. The problem with this early glass was that it became brittle and discolored over time explaining why the early works now need heavy restoration (1,6,15).

There were two techniques to make a sheet of glass. The first is called the Muff Method. Here the glassmaker or glazier gathers a ball of molten glass called a parison, on the end of an iron rod called a pontil. He then molds the glass by rotating it. Then next step the glazier takes is to blow on the end the pontil, which is a hollow tube. What he creates is a hollow bottle shape known as a muff. He then cuts both ends of the bottle away to create a cylinder. While the muff is still hot, the glazier slices down the side of the muff length wise, and then flattens out the muff to create a flat sheet (1,6,15,20).

The second method is called the sheet or crown method. Here the glazier gathers a parison onto a pontil and blows shaping the glass as in the muff method. Once the desired shape is achieved, a second pipe is attached to the other end and the first pipe removed. The glass (crown) is rotated until it becomes flat and large. The crown is then removed from the second rod. The center of the crown forms an excrescence known as a bulls-eye. The resulting glass from both of these methods often had air bubbles and an uneven texture and thickness due to cooling and fabrication. In both methods, color could be controlled by adding metal oxides to the glass. Red was made by adding iron oxide, green with copper, blue with cobalt, yellow with manganese (1,5,6,20).

One of the problems with colored glass or pot glass, is that it was not transparent enough to let much light in. This was overcome by a method called flashing. Here a very thin layer of colored glass is fused on top of a clear piece of glass. It was also discovered that if several pieces of colored glass were layered, the top piece could be etched away to allow the underlying color to come through (1,6).

Now lets describe how Theophilus outlined how he made stained glass windows. Once the design of the window was decided upon, a cartoon or sketch was created of the window. The cartoon could have been drawn on parchment or a whitewash board. This included the glass shapes and whatever images were to be painted on the glass. Usually a whitewash board was used as it was cheaper than parchment and reusable. When the glaziers were done with the project they were working on, the board could be painted over for the next project (1,6,7,15).

The glazier then chose the glass in the colors that were available to him. Each piece of glass to be cut was placed over the cartoon and the needed shape was traced onto

the glass with wet chalk. In order to cut the glass, the glazier took a glowing hot dividing rod and placed it upon the glass where it needed to be cut. When a small fissure appeared in the glass, the rod was drawn along the line, lengthening the fissure or crack until the piece was fully cut. To refine the shape of the cut glass, the glazier used a grozing rod to break away small bits of glass. A grozing rod is a piece of metal with slots cut into it matching the thickness of the glass. To smooth the edges the glazier used another piece of glass or a grindstone (1,6,7,15).

At this point any painting that was to be done on the glass was done then fired in a kiln to fuse the paint to the glass. The paint was an enamel that consisted of iron or copper oxide, powdered glass and borax flux. Around 1300 silver staining came into use. The staining (silver nitrate gamboge gum and diluted with water) created hues of yellow and was used for haloes and crowns. It was discovered that by using silver staining on different colored glass, the glazier to make different colors from a single colored piece of glass. An example would be silver staining on blue glass to create green colors used for trees and grass. Once the painting was done, the glazier then placed the pieces of glass into a kiln (clay vessels that set on top of iron rods) for firing. The kiln used beech wood for heat. The glass was placed onto iron sheets and covered with plaster. The kilns temperature was raised to about 1250 degrees. This fused the paint to the glass. The glass was then cooled slowly so that stress cracks did not form breaking the glass (1,6,7,15,22).

Once the glass was cut, the paint for the images fused, and the glass cooled, pieces could be assembled. Each piece of glass is fitted with lead strips called kames or calmes. The calmes are I or H channeled shaped strips that wrap around the edge of the glass providing the means of connecting each piece of glass together. The calmes are made by pouring molten lead into boxes lined with reeds, or into carved molds. Theophilus started with a center figure and worked his way outwards. A piece of glass was fitted into the lead calm. Pins were placed around each piece to keep it from moving during assembly. The next piece of glass was fit into place next to the first. Again, the exposed lines were encased in lead and pinned into place. When all the pieces of glass were set in their proper spots, lead was placed around the entire outer edge of the piece (1,6,7,15,22).

The next step was to permanently connect all the pieces together using solder. Solder is a low melting metal alloy composed of lead and tin, cast into sticks. After each junction of lead calmes was cleaned, the glazier uses a hot iron to melt the solder into the joints between the calms, locking the glass into place. Then carefully the assembled piece was flipped over and the other side was soldered in the same fashion (1,6,7,15,27).

Once the soldering was complete, the last step was to cement the piece. This was done by creating a mixture of powdered whiting (calcium carbonate), and linseed oil then rubbing this mixture under the edges of the lead. After the excess was removed and the glass dried, the window became waterproof and had a bit more stability to it. (1,6,7,15)

At this point the window itself was complete. In order to install the window a little bit more work had to be done. The next step was to install the banding wires. These are copper strips about 4 to 5 inches in length, soldered onto the leading and are used to secure the window. There are two types. One is called a division tie and is used to connect adjacent panels of windows. The division tie had one long strip of copper that twisted around a division bar along with the tie from an adjacent panel, holding the panels together. The second type has two strips of copper called a middle tie and is used to connect the panel to a supporting bar. The copper strips wrapped around the supporting bar, almost like a twist tie, adding extra support to the panels (1,6,7).

The last step was the installation. The window aperture was cut so that the window will fit into a L shaped channel. The bottom piece gets set into first. The next piece gets set into place on top of it. To ensure a watertight fit, the lead on the top edge of the first panel was bent over and the bottom edge of the upper piece got placed over the top edge of the bottom panel. The two windows were loosely tied together. To give more support, bars were embedded into the cement in the window frame and stretched across the window aperture. The middle ties were used to attach the window to these bars. Once the full window was in place, the ties were tightened down securing the window. The very last step was to cement the window in place to ensure weatherproofing, and securing up the window (1,6,7).

APENDIX 2

St. Columba:

St. Columba was born into a noble family on December 7, 521 in Garton, Co, Donegal (5,13,18,19). He was the great-great grandson of an Irish king in the 5th century (13). At an early age he became a priest after studying at Moville and then at Clonard, he became a Monk at Glasnevin. At the age of 25 he founded 27 monasteries that included Derry, Durrow and Kells (19).

Also known as Columcille (dove of the church), Colum, Combs, Columbus, and Columkill, Columba was known to love poetry books and manuscripts (19). This love of written material was the source of one of his most famous legends. Around 560, while studying under St. Finnian at Moville, Ireland, a copy of the Psalter (the battle book of the O'Donnell's) found its way to Columba. He wanted a copy of it for his own so he secretly copied it. St Finnian discovered what Columba was doing and because religious manuscripts were so rare, demanded that it be turned over. Columba refused. Finnian appealed to the High King of Diarmaid of Ireland. Columba lost the appeal and still refused to release the manuscript (13,17,18,19). This is where the history gets a tad confusing. In some articles, it was stated that St. Columba gathered his tribesmen and went to war with the King over the copy of the Psalter (13,17), other documents state that he went to war with the King over a fugitive that St. Columba gave refuge to (18,19). Either way ultimately led to the battle of Cu'l Dreimhne in 561 (13,18).

The battle between Columba and King Diarmaid resulted in the death of many men. Columba was filled with remorse over the death of so many men and upon counsel from a confessor was told that he must travel to Scotland and convert as many souls as he could to make up for the ones that were lost in battle (13,18). In 563 he and twelve others set off to Scotland. He first landed on the island of Iona, which ultimately became the heart of Christianity in Scotland (2,5,19). There he erected a stone cross and built a monastery. From Iona, he traveled all throughout Scotland teaching Christianity.

St. Columba died on June 9th 597 (5,13).

On an interesting side note, some of the documentation that I have read made reference to a story about Loc Ness. According to the legend, St. Columba scared away a water monster with the sign of the cross (13,19).

APENDIX 3

Origin of the Celtic cross in Celtic Christianity:

While going over all the information that I was able to find, the following seems to be pretty consistent. Besides having Druid origins, the Celtic cross also has roots in the Roman Empire. Emperor Constantine used the letters Chi and Rho which are the first letters of Christ in the Greek Alphabet. When these letters are overlapped, they look like an equal limb cross at the center of a Celtic cross. Constantine, made Christianity the official religion of the Empire and used the Chi-Rho combination with a laurel to represent as his emblem (8,10,25).

Another popular story is that St. Patrick created the first Celtic cross by placing the sign of a Latin cross over a pagan circle that represented the moon goddess, thus combining the old Druid symbols with Christian symbols (8,9,10,25).

The circle in a Celtic cross also has many meanings. The Celts used the circle to represent the never-ending circle of life, it could represent the sun or the moon (8,10,16. In Christianity the circle could represent the symbol of eternity, the world, or a halo (9,16).

Pre-Christian crosses were more symmetrical with the ring centered horizontally and vertically, such as one of the pillow crosses found at Iona. The Christian crosses had the circles placed higher on the cross. The position of the circle would be where Christ's head would be thus evoking the symbolism of a halo (16,23).

The arms of the cross to the Druids, represented the points of the compass, the four seasons, the center of the cross represents the coming together of heaven and earth (10).

Quit often the crosses are decorated with elaborate knot-work. This topic alone could be a massive research paper so I am only going to talk about the knot work related to this cross. Upon researching the relevance of the knot work in the design of the cross, most of my sources say that for the most part there really isn't any (11,12,23,25). The knot work itself represents the never-ending path of life, love and faith (12,23). The intricate folding could represent the constant crossing of spiritual and physical paths. The pattern below shows up on St. Columbas cross in three places.

It's called a Triquetra. In Christianity the Triquetra is also known as the Trinity knot and represents the Holy Trinity of the Father son and Holy Spirit. For the Pagans it can represent the mind, body and spirit, or it could have represented the earth, sea, and sky (12,24).

Resources:

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*This is a great source for examples of glass, history and procedur*e.

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Great history of the Celts

3) Finlay, Ian. Celtic Art. Noyes press, Park Ridge, NJ. 1973
Good background on art work

4) Lawrence, Lee. Stained Glass. Mitchel Beazley Publishers Limited: *1976 Another great source for examples and history and procedures*

5) Markale, Jean. Celtic Civilization. Gordon & Cremonesi publishers, 34 Seymour road, London. 1976
Great over view of Celtic heritage and history.

6) Zerwick, Chloe. A Short History of Glass. The Corning Museum of Glass, Corning, N.Y.;1980. *Good history of glass but not really for stained glass.*

7) Art History Final Project
http://loonfoot.com/ian/stained%20glass/learningmodule/index.html
Great source for procedure and supports the information from Brisac and Lawrence.

8) Ask Yahoo
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Short article but good information.

9) The Celtic Cross
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12) Celtic Knot Symbolism
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Good overview.

14) The History and Craft of Stained Glass
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Good history summation.

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Good overview paper

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Good reference for history overview.

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22) Stained Glass answers.com
http://www.answers.com/topic/stained=glass?hl=lead&hl=came
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24) Triquetra
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25) Walker Metalsmiths
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Great resource for Celtic Cross History and Symbolism.