Christmas 2007: No. 18

PULSAR

THE NEWSLETTER OF THE KITCHENER-WATERLOO CENTRE OF THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

Special Christmas Edition

Have a Happy Holiday!

In this Issue:

New Venue, Same Great Time

The upcoming annual club banquet is in a new location this year but promises to be the same great time as always.

Snapping Santa

You always hear reports about visual sightings of Santa on Christmas eve, but how do you get a photo of the jolly old elf in action?

The Observatory Remembered

Maybe you were around when the K-W Centre had an observatory, maybe you just heard about it lately. Here's a brief history going back nearly 35 years.

Working in Wood

Have you always wanted to make a telescope but thought you didn't have enough woodworking skills to build all the pieces? Here's everything you need to know to achieve great results.

The Double Cluster in Perseus by Alen Koebel, a 30-minute exposure on Elite Chrome 200 slide film through a 6-inch f/5 Meade LXD55 Schmidt-Newtonian.

Editor's Corner

Contributions are the life blood of a newsletter. Those for the Pulsar have never been that numerous – out of 208 pages in 17 issues, less than one third of the material was not written by me – but there has been a clear decline recently.

That's made me reconsider the Pulsar's continued viability. It can't exist without content. Club news and activities – the reason newsletters exist, after all – can actually be better reported on the club's web site. That leaves articles. Or it would if they were contributed on a regular basis. I just can't continue to generate most of them myself.

Given the continued lack of material what you have before you is a special Christmas issue in lieu of both a fall issue and a winter issue. I hope it suffices until such time as the Pulsar is either transformed or resurrected. Für mich ist es Zeit zu sagen Auf Wiedersehen!

Alen Koebel, Editor

RASC K-W Centre

http://kw.rasc.ca

ROYAL ASTRONOMICAL SOCIETY OF CANADA

Club Stuff

Veni, Vidi, Venue!

They say the more things change, the more they stay the same. Let’s hope that’s true for the upcoming annual K-W Centre banquet, to be held on February 23rd, 2008 at 6:30 PM.

The change is in the venue, which this year is the Italian Cortina Club, located at 22 Kevco Place in Kitchener. For those not up on their local geography, that’s off of Wabanaki drive, which is south of Fairway road bounded by Manitou and Wilson.

What we hope stays the same is the good food, great fun and fine fellowship that have always marked the banquet.

In the food department, you’re not going to be surprised to learn that the menu is exclusively Italian – that’s good because Italians know how to eat well!

With regard to fun, there will be the usual brain teasing puzzles, valuable door prizes and the presentation of the annual astrophoto contest awards.

That leaves the fellowship, which all depends on you. If you’ve never been to the banquet before, what’s stopping you? With a brand new venue there’s no better time to meet your fellow club members. Check the web site for further details. Hope to see you there!

The Italian Cortina Club in Kitchener – through a car window, in the rain. Photo by Phil Lacasse.

While artists impressions like this are common, actual photos of Santa in flight are rare.

Capturing Kris Kringle

This is not about how to kidnap someone. “Capturing” in this case means recording an image on film or digital imager. It’s one thing to photograph a celestial object – most of them don’t move fast – quite another to catch the jolly old elf on his journey around the globe. If you doubt just how difficult, count how many pictures of Santa in flight you’ve seen. Now subtract the obvious fakes. The point is made.

Santa is often called an Identified Flying Object (IFO) – the most famous example of one, in fact. It would be more accurate, however, to call him a Deniable Flying Object (DFO). While children have no trouble making an identification, adults usually deny it – unless they are in the presence of the child making the sighting.

Most adult denial stems from what scientists call the Santa Problem. How does he manage to deliver all the toys in one night without breaking the laws of physics? The answer is simple: cloning. There are actually several million Santa’s flying around on Christmas Eve, which makes the probability of photographing one of him at least a little larger than zero.

But you do have to be prepared. Just as with meteors, your best bet of finding Kringle in flight is to use your unaided eyes. When you spot him (*if*, really) you have to be ready with a fast telephoto lens of moderate focal length.

A normal or wide angle lens won’t work, since no one will believe that that dark smudge in your photo is really Santa. A long focal length lens or a telescope is equally ineffective, since he travels so fast you’re not likely to be able to track him at high magnifications.

If you do manage the unlikely, be prepared to be met with scepticism. Kris Kringle is, after all, a DFO, hence many people will label your photo a fake, sight unseen. But you’ll know the truth!

Club Stuff

Remembering the Ayr Observatory

by Alen Koebel

New members of the Kitchener-Waterloo Centre will no doubt have heard of the “Ayr Observatory.” They may have seen a reference to it on the club’s web site, stating that the site is officially closed and warning not to trespass on the grounds. They may have heard mention of the it in a club meeting. What they won’t have heard much about is its history.

The site of the observatory, a few kilometres west of the small town of Ayr, was merely a small hill in a farmer’s cow pasture when it was spotted by members of the Grand Valley Astronomers (GVA) one day around 1972.

Geologically, the hill is a small moraine, a mass of rubble and aggregate left behind when the great glaciers of the last Ice Age retreated from southern Ontario. For thousands of years it sat, with little more than wild animals grazing on the grasses that took seed there. Then, about two hundred years ago, settlers and farmers from Germany, Scotland and other European countries moved in. The land surrounding the hill became a cow pasture.

Logo of the Grand Valley Astronomers.

The hill itself, however, with it’s relatively sharp peak and steep sides wasn’t of much use for grazing cattle. But it was ideal as the site of an astronomical observatory, long a dream of the GVA. Not only did the peak of the hill face south, providing a totally uninterrupted southern horizon, there were no large towns in that direction, hence no sky glow to mar the view.

The site in 1982; the two-story dome, roll-off roof shed and small dome. Photo by Peter Daniel.

The site was also conveniently close to Kitchener, about 20 km to the north. Today, with almost the whole of southern Ontario awash in light pollution, being close to a fair-sized city would be a problem. But back then Kitchener was much smaller than it is today. It’s hard to imagine now how dark the skies were at the site in 1972, but you would have to drive into the Bruce Peninsula to see their equal today.

By early 1973 the GVA had made an arrangement with the land owner, a Mr. Dance, allowing the club to build on the hill, which had been dubbed “Pinnacle Hill.” The initial plans called for a 14.5-foot diameter two-story silo with a rotating dome and a 25-foot by 8-foot single-story adjoining building, all within a fenced-in lot measuring approximately 60 feet by 40 feet.

Construction of the observatory began that summer, enabled by an *Opportunities for Youth* grant from the Trudeau government. Besides the grant, what made the project possible was the volunteer labour of a number of students from Wilfrid Laurier University (WLU), who were assisting club members who also volunteered their time and energy to the project.

The students were there because of Ray Koenig, a Physics professor at WLU. Ray was one of the prime movers of the observatory project and would in the following year become the club’s president, a position he held often thereafter.

In parallel with the construction of the building (singular because the single-story adjoining room was never built), several members were working on the telescope that would be housed inside the shiny new dome. It was a German equatorially mounted f/5 Newtonian reflector of 12.5 inches aperture, which back in those days was

Peter Daniel in 1976, using the then new 12.5-inch Newtonian reflector. Photo by Peter Daniel.

a very large instrument indeed. The telescope was designed and built primarily by Hans Shilter and Herbert Shilling, both of whom were machinists of considerable skill. And machining was very much necessary, as this was the Bismark of telescopes, a veritable battleship in weight and solidity.

The official "grand" opening of the observatory occurred in 1976, but the site was ready to use well before that date. And use it club members did.

I was one of those members privileged to use the brand new 'scope along with friend and fellow club member Dave Schwartz. The first thing that one noticed when entering the dome after a climb up the steep stairs from the first level was the dome's size – the room could easily hold half a dozen people.

I also remember how easy the telescope was to use. Its buttery-smooth German equatorial mount and rotating secondary cage made observing effortless. The manual crank to turn the Ash dome (the club didn't purchase the optional motor), on the other hand, was always a little stiff, but reefing on it just warmed you up on cold winter nights.

The telescope was not so easy to use for astrophotography, since it was intended purely for visual use. While it had an excellent clock drive, it lacked any counterweights that would have been needed to balance a camera. Nevertheless, Dave and I did manage to take some piggy-back shots with our cameras clamped to the secondary cage.

The crest of the hill south of the dome could also be used for observing, with concrete pads for setting up telescopes. You could even drive a car up to the dome for easy unpacking and packing.

This state of affairs didn't last long, however. Astrophotographer Gerald Kennedy was the first to install his own private single-story dome a few feet south of the main dome. Two other club members joined together to build a roll-off roof shed on the south edge of the site. There went the neighbourhood!

However, all the original owners of the extra buildings eventually moved away from the area, and the club – now the K-W Centre of the RASC – gained stewardship of the structures.

While Ray Koenig was president he was adamant that the telescope not be modified in any way. The wisdom of this policy was proven after he was no longer president when the telescope clutches and drive mechanism became damaged following an attempted modification for astrophotography in the early 90's. The entire telescope was removed for repairs and replaced with a Celestron 8-inch Schmidt-Cassegrain.

Of course, the telescope swap was supposed to be temporary, but as it turned out the repairs dragged on for years. Eventually, the 12.5-inch was reinstalled. But it didn't work as well as it had before it was damaged and it soon became damaged again, likely as a consequence of the questionable repair job.

Given the work and money required to fix it yet again and the state of modern telescope technology, it was decided to retire the 'scope and buy a replacement. In the spring of 2003 the old telescope was removed. By the fall the replacement 'scope – a 14-inch Schmidt-Cassegrain from Meade – had finally arrived and was temporarily installed.

Early in 2004 the new telescope was permanently mounted to the main dome's pier on an equatorial wedge. In July of that year the club celebrated the official grand re-opening of the observatory, with an estimated turnout of 350 visitors.

The site was used fairly frequently until the fall of 2007 when the club officially closed the facility. Mr. Dance, you see, sold a good chunk of his property – including the hill – to CP Rail, which will be building a marshalling yard starting early 2008 and needs the aggregate the hill contains as raw material for the yard's construction.

That is how after nearly 35 years of existence, the Ayr Observatory ceased to be.

Telescope Making

Wordworking for Telescopes

How To Get Great Results with Limited Equipment

by Wayne Joslin

The Dobsonian mount offers the tantalizing possibility that you can build your own telescope without metalworking equipment or skills. You just need some woodworking background and common hardware. However, accurate construction is still important. There are ways to obtain both accurate and good-looking results without the elaborate woodworking shops some of us are blessed with. A sabre saw and a router can do it all!

The Approach

My approach has always been to minimize filing and sanding, because they are inaccurate and they are hard work. (I'm allergic to the latter!) That means that the tool cuts have to be exact and smooth. If you've worked with plywood or particle board, you'll know how difficult both those objectives can be.

The approach I use can be described briefly as follows:

1. Rough cut most parts close to size.
2. Make a template for the final cut, doing any sanding or adjustment on it.
3. Use a pattern-following router to make the final cut on the plywood.

The template is especially useful if you have multiple similar pieces: two or four sides, top and bottom, left and right.

Now let's get down to details!

Figure 1 – Pattern bits for routers: On the left a top-bearing bit, in the middle a bottom-bearing bit and on the right a double-bearing bit. Photos courtesy of Lee Valley Tools.

The Tools

An inexpensive sabre saw is used to reduce big sheets to manageable size and to rough out final shapes. It's tough to get an exact cut with a sabre saw, and they tend to leave a ragged edge. Use a medium to fine blade, sharp and of good quality. Blades are inexpensive, so this is not the place to cut corners. A ⅜ inch dill bit, used to make a hole to start the saw blade, allows you to cut closed sections such as the wedges in the bearing sector.

Once the pieces are rough cut to shape, the finish cut is done with a router. This has the advantages of cutting at much higher speed and of cutting in the plane of the wood, rather than at right angles, so there is far less tear-out. When used with a template following pattern bit, accuracy can be delegated from the operator to a template.

If you now have a router, it can be used, even though it may not be ideal. A plunge router with a ½ inch collet is the ideal, and prices are within the grasp of most. The plunge feature allows the finish cut to start against the pattern (more later) and the ½ inch collet and bits are stiffer. ¼ inch collets and bits will work, but if you're rushing out to buy, get the bigger one.

Pattern bits (also referred to as template or flush trim bits) are the secret ingredient. They are straight bits with a ball bearing of exactly the same diameter on either the top or bottom, or both. Figure 1 shows a top-bearing bit on the left, a bottom-bearing in the middle, and a double bearing on the right. The bearing rides against the template fastened to the top or bottom of the work (on the bottom in the case of the double bearing bit) and the router cuts to the same dimension. Routers, spinning at high speed (ca. 20,000 rpm), produce a smooth cut which requires minimal finishing. Some 220 grit sandpaper to knock the fuzz off the edge of the cut is usually sufficient.

There are very few other tools you need. Clamps for glue-up; some sort of drill – electric, manual or drill press; a good ruler. A quality 24 inch square is useful but there are alternatives.

A router table is especially useful, as it lets you see the work more clearly. Even an inexpensive knock-up will work if your router can be fitted to it. The one in Figure 2 is made from four pieces of particle board and fits the square bases available from Oak Park Enterprises (http://ca.oak-park.com/ catalogue.html? list=BP-BP11-).

The Procedure

Rough cutting with a saber saw allows me to cut the large plywood sheets to something easier to handle, and makes the router cut as small as practical. With Baltic birch plywood, which is quite splintery, I keep the saw cut about ⅛ inch away from the final line. To cut straight lines use the factory edge of a piece of plywood or, preferably, ¼ inch MDF (medium density fiberboard or mighty dusty fiberboard, your choice), which is straight and smooth. The factory corner can usually be relied upon for squareness too, if you don't have a carpenter's square. Here's to do the various types of cuts.

Straight Cuts (e.g., box sides and bottoms)

1. Draw the part accurately on the final material.
2. Rough out with saber saw.
3. Align the straight factory edge of a longer piece of MDF with your layout and clamp securely.
4. Using a pattern bit, trim to the line.

Arc cuts (e.g., bearing sectors, weight-relief cutouts)

To produce the spokes and arc in the bearing sectors, the template of ¼ inch MDF is itself a challenge to make. The answer is to use templates to make the templates! It's actually quick to do, because the sector template is composed of circles and straights.

1. Draw the part accurately on the template material.
2. Rough out with a saber saw and set aside.
3. Use a circle cutting fixture (below) to cut over-length arcs (inside or outside) in another piece of template material.

Figure 2 – A simple router table.

4. Cut straight pieces from spare template material as required, cutting to final width if appropriate (e.g. for sector spokes).
5. Assemble arcs and straight pieces on the set-aside template layout and fasten with brads or double-sided tape. If using tape, be careful! It can shift part-way through a cut and ruin it. If using tape, squeeze it tight using a clamp or vice when you can, and keep the side pressure to a minimum. I add a clamp when I can.
6. Cut the template to final shape with the router, being guided by the lashed-up pieces
7. Set the finished pattern on the final material temporarily and draw the outline. Rough out with the saber saw.
8. Fasten the template well to the roughed-out piece (see fastening comments above). Rout the final part to the template.

Circle Cuts (e.g., upper cage rings)

1. Draw the part accurately on the final material and drill a ¼ inch hole in the centre. (I particularly like the Lee Valley ¼ inch HSS Lipped Brad Point bit 07J02.16 for its accuracy and clean cutting.)
2. Fasten the material to a sacrificial board (e.g. MDF, Particle Core, kitchen table). For cage rings, use nails through the eventual post screw holes to make sure the rings don't move when cut free. Both the inner and out waste material should also be tacked down before cutting to avoid missiles. Use finishing nails and set the heads below the surface.
3. Continue the ¼ inch centre hole into the sacrificial board.
4. Use a circle cutting fixture (below) and rout the outside radius. Test the radius on a scrap first. Here's where the plunge router earns its keep. Once the radius is set up and the compass point engaged, plunge the bit into the final material. Cut in increments of about ¼ inch depth, especially if using ¼ inch shaft bits. The last cut should cut into the sacrificial substrate slightly.

If you don't have a plunge router, it's difficult to get the compass centre point engaged while tipping the bit into the work. To be safe, take shallower (~⅛ inch) cuts and start by setting the router base on a piece of ⅛ thick stock, and drive it off into the wood.

More Details

Need I say it? Always cut so the router bit, which revolves clockwise when viewed from above the router, is entering the wood along the line of cut, which resists your pushing force. Otherwise it will tend to self-feed and can make a mess at best, or hurt you at worst.

Watch that any clamps are not in the way of the router or your hands. When cutting straight lines, this is usually possible, but intricate pieces probably require other fastening. Keep fastening nails out of the cut line.

For most telescope parts, I also use a round-over bit after shaping, to kill the sharp edge. This approach removes the fuzz and any stray splinters; looks good,

Figure 3 – A round-over bit. Photo courtesy of Lee Valley Tools.

and reduces night-time injury from sharp telescope corners.

Round-over bits (Figure 3, from Lee Valley Tools again) have a bearing like the pattern bits, but the work becomes the template. I frequently use only a part of the bit's curve, to improve the looks and reduce the possibility of cutting too deeply, which will leave a line impossible to remove from most plywood. For the telescope work illustrated here I used both a ¼ and a ⅛ inch radius bit, but the ¼ inch bit is sufficient.

A rabbeting bit, like the pattern bit but with cutters extending beyond the bearing, is useful in box construction to produce strong and accurate lapped corners.

You may notice in the photos that my mirror box and rocker box both use box (or finger) joints. These are also made with the router but are considerably more challenging and beyond the scope of this article.

Lapped corner joints are much easier to produce and are stronger than the butt joints recommended by David Kriege and Richard Berry in their book *The Dobsonian Telescope: A Practical Manual for Building Large Aperture Telescopes (*Willmann-Bell, 496 pages, ISBN 0943396557)

Glue-up is also easier with a lap joint because the lap helps alignment. Cut the rabbet deeper than the plywood thickness a trifle (just enough to feel the edge beyond the joint), then use the pattern bit after the glue dries to clean up the edge and remove glue squeeze-out. I do this with the box joints too.

If your pattern bit is long enough, it is much better to stack two opposing sides together with nails or double-sided carpet tape and rout the two pieces at once. Then the sides are identical and it's easier to keep the finished box square.

This is especially important when routing the bearing sectors and the mating arc in the rocker box. A Dobsonian needs these surfaces to be circular, identical and coaxial for smooth movement. I left the center holes in the sectors and carefully cut half-circles in the center of the mirror box top, then used a ¼ inch drill rod spanning the mirror box to position the sectors.

For circles larger in diameter than the router base you use a compass attachment on your router. These are available commercially (e.g., Lee Valley Universal Circle Jig 46J91.01, $27.50) and are included with some routers.

Some routers have two horizontal holes about ½ inch diameter, intersected by tapped holes for locking screws, to be used for the compass. If your router doesn't have these, use the Lee Valley jig or make a new base to replace the one on your router. Use MDF for this, and you can drill the pivot holes directly into it or fix up an adjustable center of your own devising.

My router had the holes, so I made my own compass from two lengths of drill rod (mine was metric sized, available at Metals Supermarket) and a piece of maple (Figure 4). The compass point

Figure 4 – A home-made compass.

is actually a piece of ¼ inch diameter drill rod which is inserted through a hole in the maple block and held in position by a bolt. The radius is set by sliding the maple block along the bars and locking in position with bolts.

For circles smaller than the router base, where the centre will lie under the base, the above compass won't work. You can, of course, drill a ¼ inch centre hole in your router's base plate but there's no adjustment available and eventually you'll ruin the base plate.

Better to buy a commercial jig designed for the job (Lee Valley Precision Circle Jig 46J91.03, $28.50 – No, I don't get a commission!) or make the simple modification I did. A short piece of thin steel is screwed to the maple block on the compass so that it rides under the router base. A piece of ¼ inch drill rod silver soldered to the end becomes the new centre. I had to tape shims on the other side of the base to keep it level (Figure 5). That wouldn't

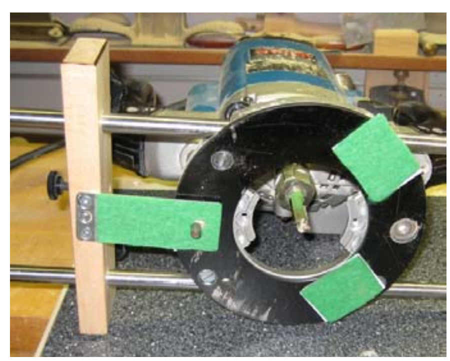

Figure 5 – A mod for cutting small circles.

be necessary if your thin metal covered the entire base. The green is some felt glued on to prevent scratching

For bearing sectors which are composed of semi-circles an ordinary router works fine and avoids the inevitable bump at the plunge. Just set up for the cut outside the semicircle, adding shims to keep the router level if necessary, and rotate into the cut in the normal way.

I don't use the template to cut the actual bearing surface of the sectors – the ¼ inch centre hole is included in the final sector and is used to cut the final radius. That way the critical bearing surface doesn't go through two iterations with possible errors accumulating.

In the illustrated rocker box you need one external circular template and one internal, to produce the inside and outside arcs of the pie-shaped cut-outs. These circles are joined by spokes. The spokes are made from one or more lengths of ¼ inch MDF cut to exact width, either by table saw or by the straight-line router technique described above.

The sector layout is done on the sector template. The center ¼ inch hole is drilled next, and then the pie wedges roughed out (⅛ inch from the line) with the sabre saw. A small-diameter circle for the hub, also with a ¼ inch centre hole, is fastened in place with tacks after using a ¼ inch diameter rod to align it with the pattern. Carpet tape can be used but there is a danger it will give way at the wrong time, creating a divot in your template.

Divots can be repaired using a mixture of sawdust and glue, re-cutting when it is dry. This is one advantage of the template method. Repairing a divot in the actual sector doesn't look good no matter what you do short of body filler and opaque paint.

With the center circle in place, fasten down the inside arc, aligning it to the template drawing. Now cut the spokes

Figure 6 – A finished rocker box.

to length and fasten them in place. Since every corner automatically gets a ¼ inch radius by using a ½ inch pattern bit, the joints between the spokes and circles need not be exact – 1/16 inch gaps are fine.

Once the components are in place, use the pattern bit to create the final template. Remove the layout pieces. Use the template to draw the sector on the final stock. In my case the sectors were one inch thick, made from two pieces of ½ inch Baltic birch glued together before lay-out.

Drill the ¼ inch center hole, then clearance holes for the blade (I use one at each corner for convenience) and rough out with the sabre saw, again about ⅛ inch inside the line. Then route to final size against the template, except for the bearing arc, which remains roughed out at this point.

Carefully set the router compass radius to the desired bearing radius and trim the bearing arc using the previously drilled center hole.

If your sectors are hubless, cut the bearing sector first. Use a substrate of ½ inch or ¾ inch MDF, do a layout on it, and fasten the hubless sector to it with flat-head screws through the waste.

Drill a ¼ inch hole through a piece of scrap the same thickness as the sector and locate it on the substrate with a pin, leaving enough space at the top for the compass center. Cut out the waste with the screw holes using the template.

Carpet tape should be adequate here, since the pattern surface is large. Use lots of tape on clean material and use a clamp (Kwik-Clamps are great for this) to squeeze the pattern and stock into contact. If you're nervous, small finishing nails can be used and the holes filled after, with minimal notice.

I used the identical technique on the inner cut-outs of the rocker box before gluing the two pieces together.

An Example

I'm going to use the rocker box shown in Figure 6 as an example of the techniques I've described. The bottom is laminated from two layers of ½ inch Baltic birch plywood. The inner layer has cut-outs to save weight. Here's how it was made.

First, I routed a circle and inside arc (more than 180°). I then cut a strip of 1½ inch wide MDF into three spokes and used a file on one end of each spoke to rough curve it to fit the circle (see Figure 7).

I fastened these pieces to the roughed-out template using a dowel for the disk and finishing nails for the rest. The nails weren't set because I used a router table with a top bearing. I routed two of the

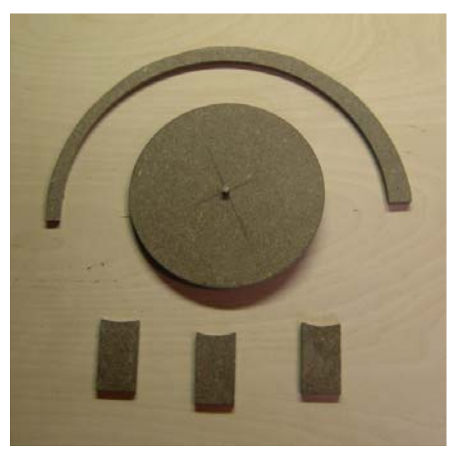

Figure 7 – Routed and cut pieces of MDF.

Woodworking cont'd…

Figure 8 – The template being constructed.

quarter-circle cut-outs, then moved the arc and one spoke to the opposite side and repeated the routing (see Figure 8).

Figure 9 shows the completed template. I used the same piece of MDF for the rocker box side cut-outs, which can be seen at the top.

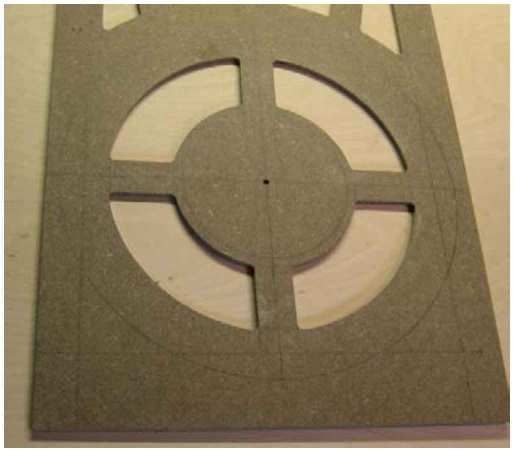

Figure 9 – The completed template.

The actual rocker box bottom (figure 10) was rough cut with a sabre saw using lines drawn from the template, the template re-fastened and routed. (I used a separate template for the corners.) Then I rounded the upper side slightly with a round-over bit, and glued on the other piece of the ground board. I used the same process for each side.

Figure 10 – The rocker box bottom piece.

After the glue-up of the bottom, sides and ends, I cleaned up the joints with a top-bearing bit. I used the same techniques to make the cage rings, mirror box and ground board.

Modest Tools, Great Results

The example above shows that great results can be achieved using only a sabre saw and a router, both of which can be obtained for a modest investment.

Using the techniques I've described, anyone can make the wood components required for a Dobsonian telescope.

Want to join our club?

To become a member please call Peter Clarke at 519-763-0184 or send e-mail to pclarke0184@rogers.com

In Coming Issues…

- Only the Shadow knows…

K-W RASC Executive

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The K-W Centre of the Royal Astronomical Society of Canada usually meets on the second Friday of every month excluding July and August. Meetings are held in the Science Building at Wilfrid Laurier University in Waterloo, Ontario. All residents of the Milky Way are welcome but must supply their own transportation.

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