

Fabrication Instructions for the Production of Foam Crystal Loading Dewars

This document describes the how to fabricate the foam **crystal loading dewar** shown below. The machining steps and setup are explained in detail with pictures and photos. Drawings in SolidEdge and PDF file formats are provided. Also, sources of the foam material and fabrication tools are provided in the references page.

The work described in this document should only be carried out by a qualified professional machinist. All standard industry safety practices and protocols should be followed.



The **crystal loading dewar** consists of two parts: the “**crystal loading dewar**” and the “**crystal loading dewar lid**”. Following, these fabrication procedures are divided into two parts: 1) fabrication of the **crystal loading dewar** and 2) fabrication of the **crystal loading dewar lid**.

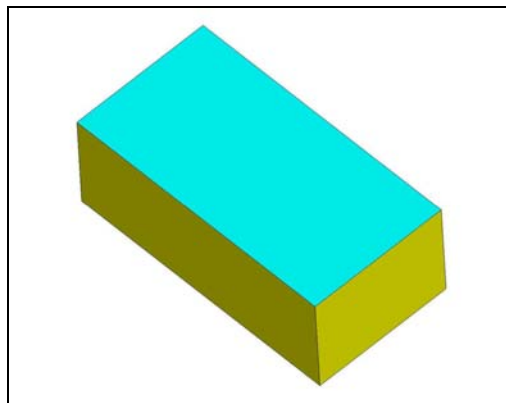
Part 1: Fabrication of the crystal loading dewar

The factory supplied 72” x 48” x 8” 4 lb density PCF foam sheet (see reference 1) is constructed of layers of 72” x 48” foam sheets which are heat laminated. To ensure completely laminated material, trim off the edges of the foam sheet before use.

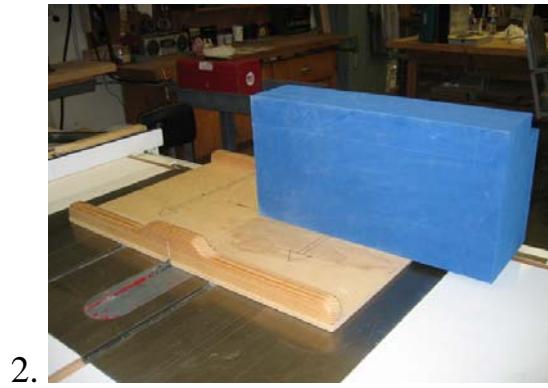


The fabrication directions in part 1 been divided into nine main steps. The foam material has to be cut to the final size (21.5" x 11" x 8") with smooth finished surfaces (steps 1 to 4) before machining on the milling machine (steps 5 to 9). In the following section pictures are shown to illustrate these steps. Yellow highlights in the pictures indicate the surfaces to be machined in each step.

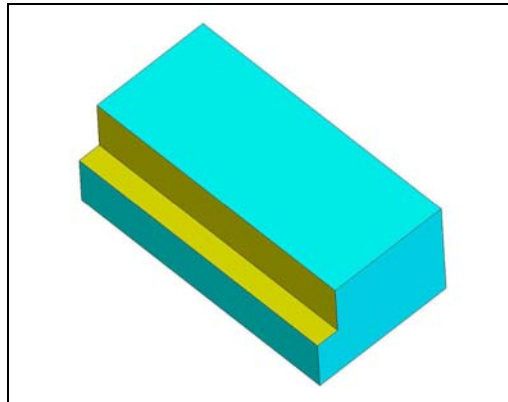
Step 1. Form Dewar Blank



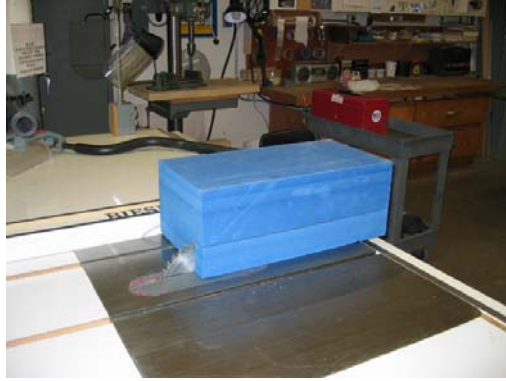
Six foam strips (48" x 11" x 8") may be cutout from the foam sheet using a vertical band saw (photo 1). Two foam blocks (21.5" x 11" x 8") can be cut out from each foam strip using a table saw with a cross cut table (photo 2). (We used a table saw for this operation because our band saw can not accommodate the 21.5" length of the foam block. Since our table saw is not deep enough to cut through the 8" thickness of the foam strip, this operation needed to be done on four sides of the foam strips. A hand saw was then used to make the final cut. We first cut the foam block longer than the final 21.5" length in this operation and then used a vertical band saw to cut the exact size – this should give the best surface finish.)



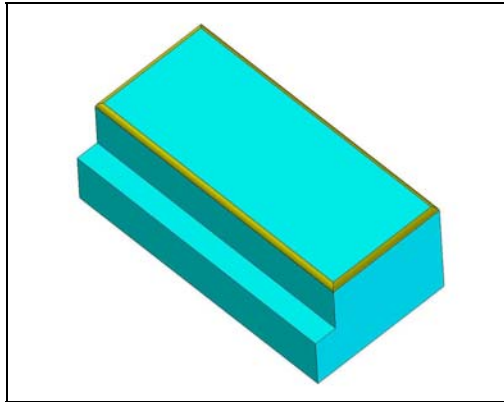
Step 2. Cutout Side Step



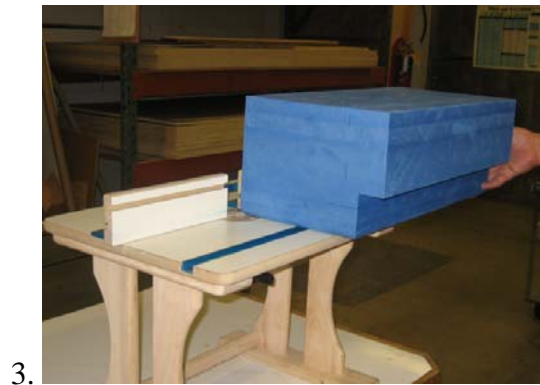
Use table saw with a fixed fence (photo 4) to cut a 1.75" x 4" step along the 21.5" long side.



Step 3. Fillet Top Edges

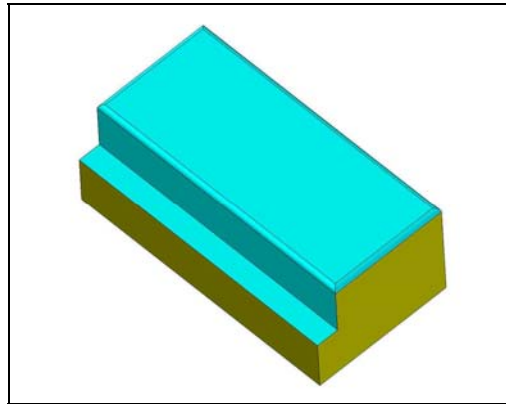


Add 0.5" fillets to the four top edges of the foam block using a routing table (photo 3). The radius cutter (photo 4 & ref. 2b) should be installed to the tool holder (photo 5) at the bottom of the table.





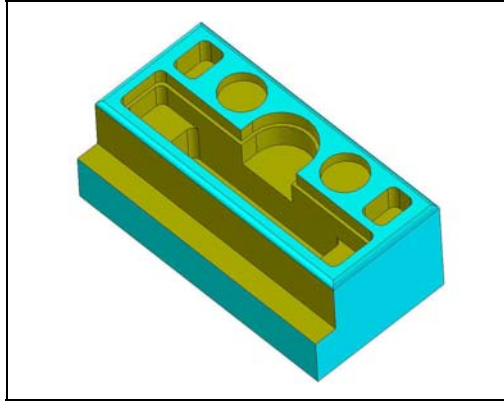
Step 4. Smooth Saw Cut Surfaces



Use a jointer on each of the saw cut surfaces of the foam block to smooth out the rough cut surfaces (photo 6). Step 3 and 4 may need to be repeated to ensure a clean seam between the fillets and the flat surfaces.



Step 5. Mill Pockets and Cutouts



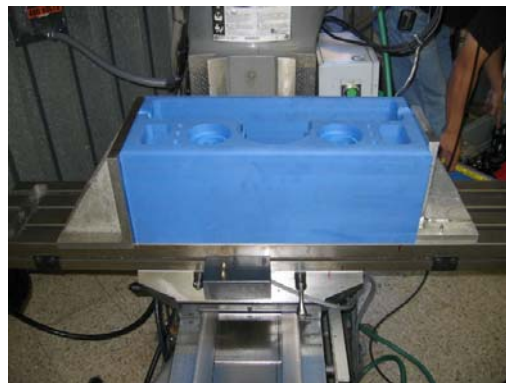
- An adjustable cool air gun (photo 7 & ref. 2a) should be attached to the milling machine to cool off tool bits during milling. (This helps prevent the cutting tool surfaces from heating to temperatures that may mar the surface finish of the cutout.)
- Attach double-sided tape to the feeding table of the milling machine and the angle brackets (photo 8). The double-sided tape is then used to hold the foam block firmly (photo 9) without distorting its shape.
- Connect the straight cutter (photo 10 & ref. 2c) to extension end mill holder (photo 11 & ref. 2g), and install them to the milling machine (photo 12). This cutter is then used to cut out the cavity as well as smooth out the step surface left by the table saw.



7.

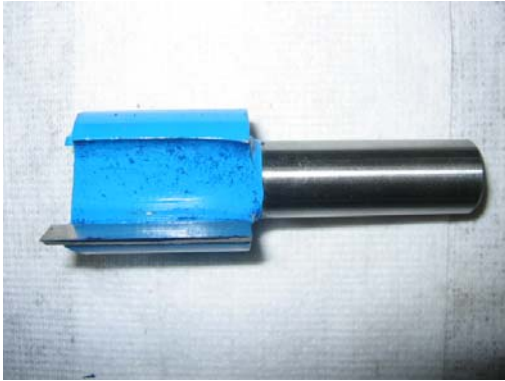


8.



9.

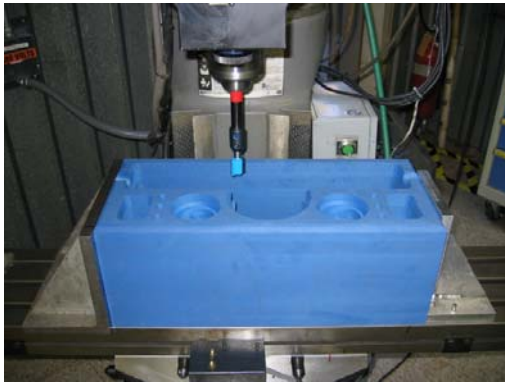
10.



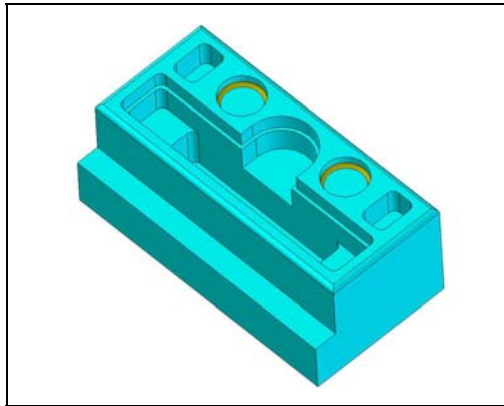
11.



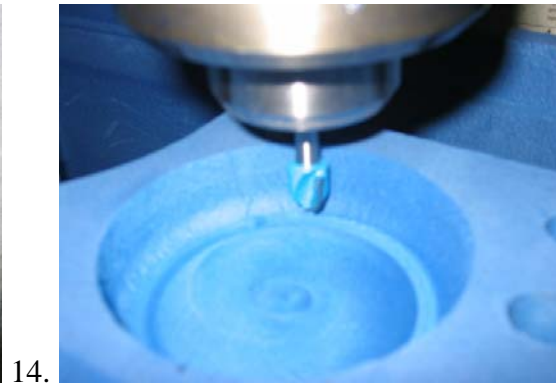
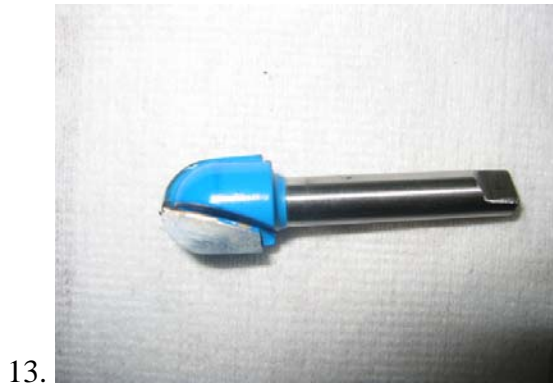
12.



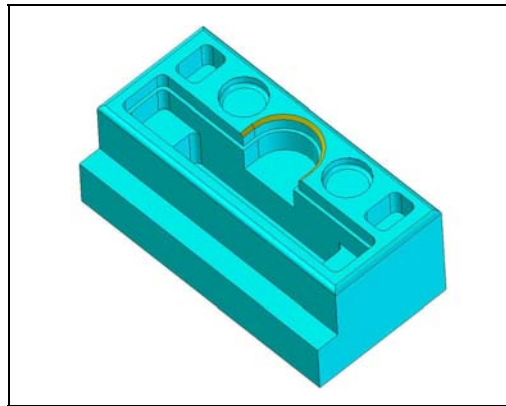
Step 6. Radius Circular Cutouts



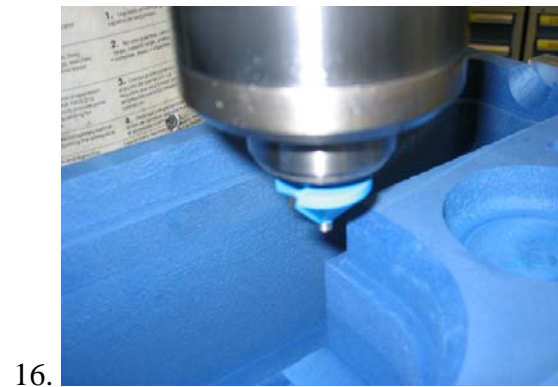
Install the ball cutter (photo 13 & ref. 2d). Add a radius to the bottom of the two round blind holes (photo 14).



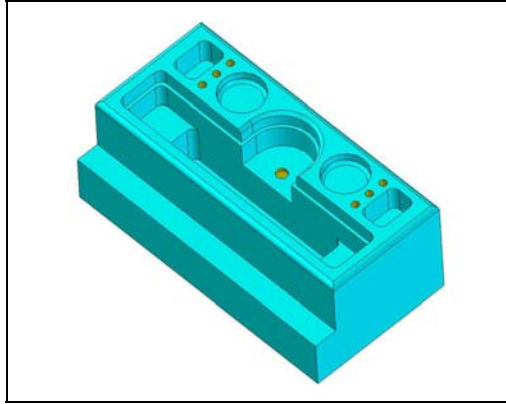
Step 7. Chamfer Half Circle



Use the chamfering cutter (photo 15 & ref. 2e) to add an 0.25" chamfer to the top edge of the half circle (photo 16).



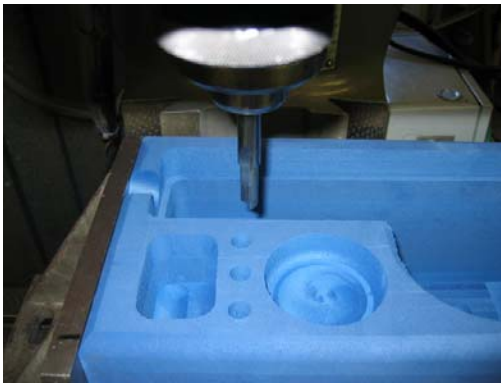
Step 8. Mill Holes



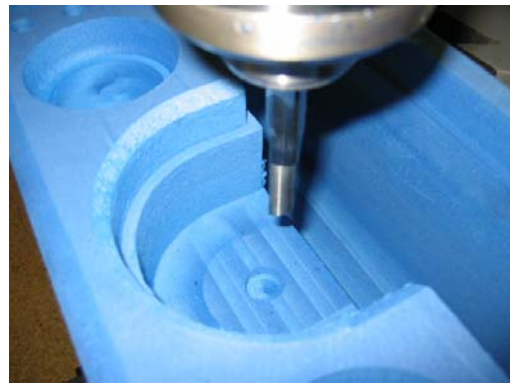
Use the two straight center cutting single end mills (photo 17 & ref. 2f) to drill the blind holes (photo 18) and pocket out the indent (photo 19).



17.

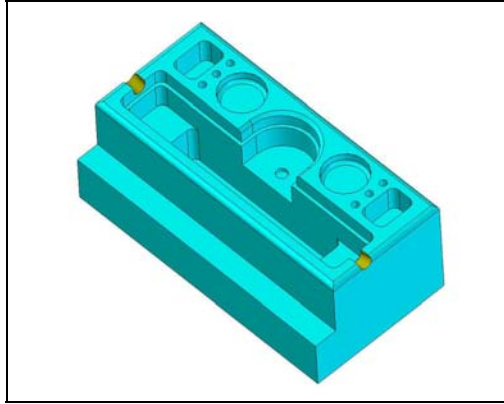


18.

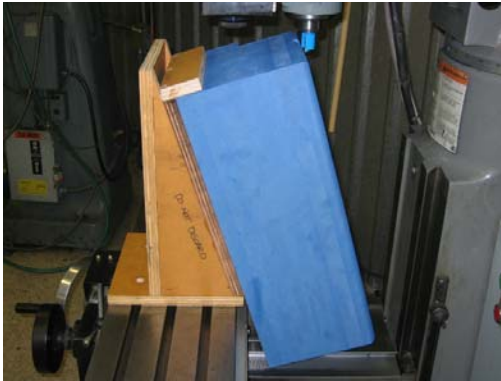


19.

Step 9. Cutout Angled Side Notches



- An angle fixture with a 16 degrees inclined angle should be fabricated using plywood.
- Set up the angle fixture and check for proper clearance and then attach the foam block to the fixtures using double-sided tape (photo 20).
- Use Straight bit cutter (photo 10 & ref. 2c) to machine two half circle notches (photo 21).

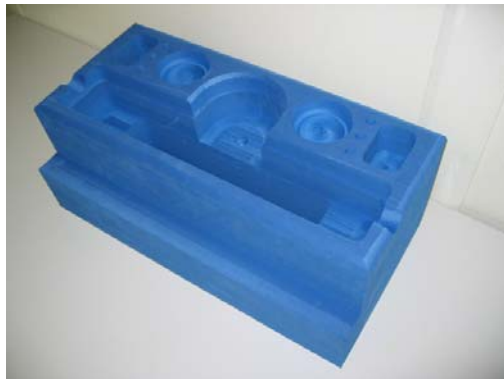


20.



21.

At this stage, all the machining of the **crystal loading dewar** is complete. However, 120 grit sand papers should be used for cleaning up any surface roughness. The surface finish of the completed **crystal loading dewar** should look like the example piece shown below.

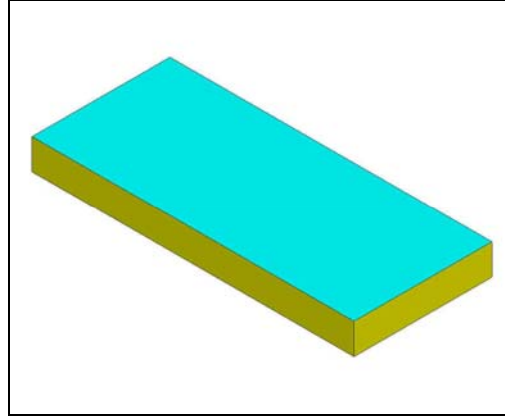


22.

Completed crystal loading dewar

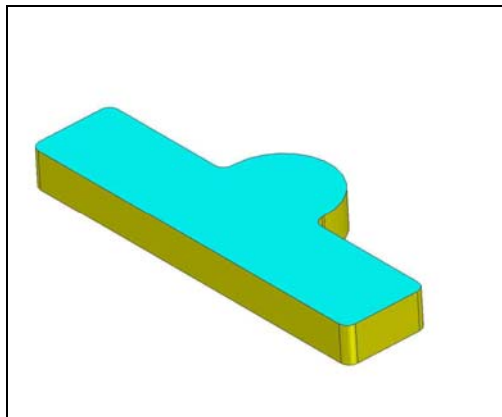
Part 2: Fabrication of the crystal loading dewar lid

Step 1. Foam Dewar Lid Blank



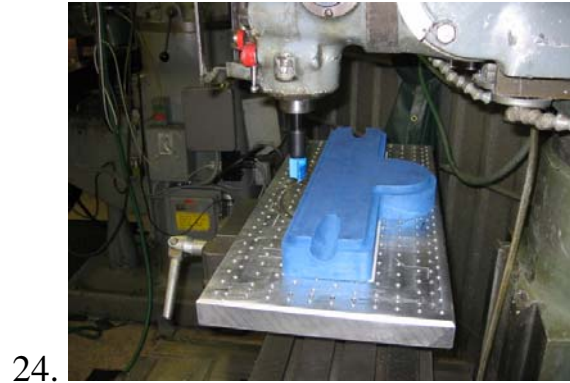
Use a table saw to rough cut a form piece of 21" x 9" x 2" from the factory supplied 72" x 48" x 2" 4 lb density PCF foam sheet (see reference 1).

Step 2. Machine Lid Shape

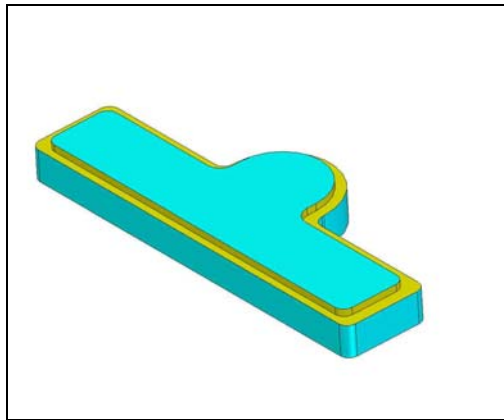


Apply double-sided tape to the feeding table of the milling machine (photo 23) to hold the lid blank firmly to the feeding table. Install the extension end mill holder (photo 11

& ref. 2g) and straight cutter (photo 10 & ref. 2c) on the milling machine (photo 24). Use this cutter to machine the side of lid blank to the final shape.

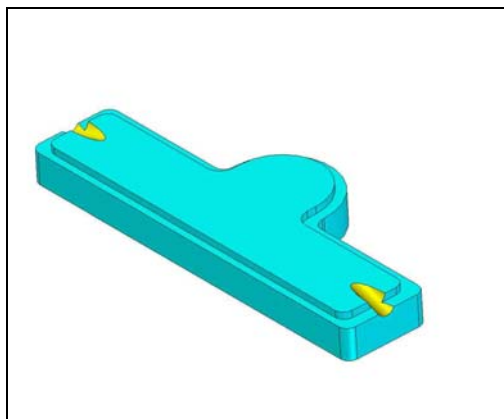


Step 3. Cutout Step

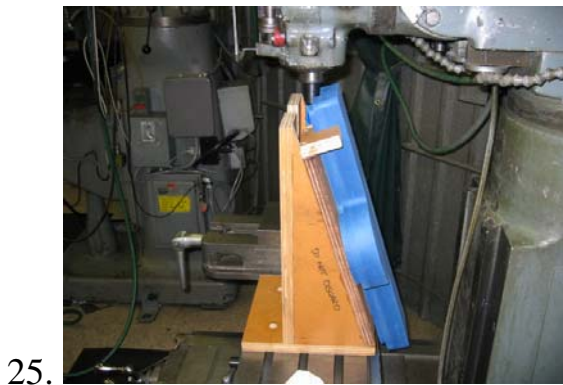


Using the same setup and tools to cut a step around the top edge of the foam sheet.

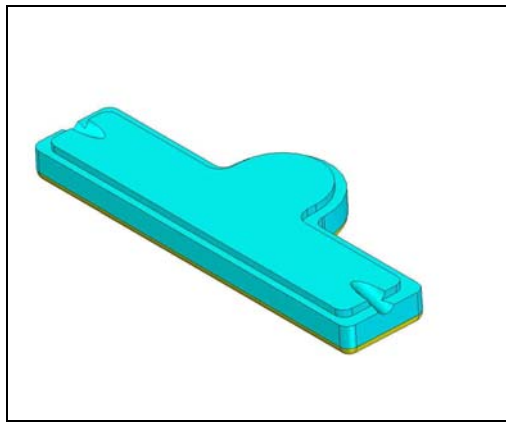
Step 4. Cut out angled Side Notches



- An Angle fixture with a 16 degrees inclined angle should be fabricated using plywood.
- Set up the angle fixture and check for proper clearance. Then attach the foam sheet to the fixtures using double-sided tape (photo 25).
- Use the same cutting tool as the previous step to machine the two half circle notches (photo 26).



Step 5. Fillet bottom edges



Add 0.5” fillets to the bottom edges of the foam sheet using a routing table (photo 3). The radius cutter (photo 4 & ref. 2b) should be installed to the tool holder (photo 5) at the bottom of the table. At this stage, all the machining steps are complete. However, 120 grit sand papers should be used for cleaning up any surface roughness. The surface finish of the completed **crystal loading dewar lid** should look like the example piece shown below (photo 27).



27.

Completed crystal loading dewar lid

References for Material and Tools Sources

1. Foam material: 4 lb density PCF crosslinked polyethylene foam (commonly called Artilon, Epsilon or Youngboard) in blue is used. For crystal loading dewars a 72" x 48" x 8" sheet is ordered and for the crystal loading dewar lid a 72" x 48" x 2" sheet is used as the starting material.

Vendor:

Technifab Engineered Products
1355 Chester Industrial Parkway
Avon, OH 44011

Contact:

Dana Keane
Customer Service
Technifab Engineered Products
Office: 440-934-8324 ext 22
or
Michael Stroup
Technical Sales Representative
Office: 440-934-8324
Cellular: 440-476-6511
E-mail: mikestroup@technifabfoam.com

2. Machining Tools:

First Vendor:

MSC Industrial Direct Co., Inc.
75 Maxess Road
Melville, New York 11747-3151
1-800-645-7270 - General Customer Service
<http://www1.mscdirect.com/cgi/nnsrhm>

Tools:

- a. Adjustable Cold Air Gun (magnetic base, 5-micron auto-drain filter), #06527766
- b. Radius Round Over Bit Cutter, #01852599
- c. Straight Bit Cutter, #01852094
- d. Core Box Bit Cutter, #01852177
- e. Chamfer Bit Cutter, #01852672
- f. 2 Flute Straight Centercutting Single End Mill, #80751936

Second Vendor:

A. B. Tools, Inc.
4302 Solar Way
Fremont, CA 94538-6335
Phone: 510-657-1200
Fax: 510-657-5958
E-mail: abtoolsinc@aol.com
<http://www.abtoolsinc.com>

Tools:

g. Extension End Mill Holder, # ACH ½

3. Shipping Box (This container that can be used to ship individual dewars.)

Vendor:

ULINE
800-295-5510
Part Number: S-4159 (comes in pack of 20)
Description: 22" x 12" x 12