Foam Glass Mirror Blanks

for

Hawaii Alt/Az Initiative

January 2011

by

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&

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www.OTFDesignsLLC.com

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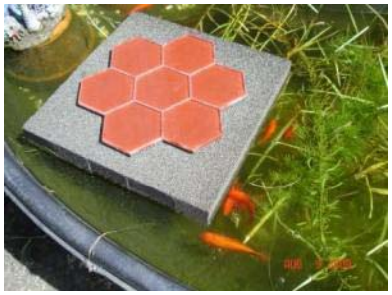
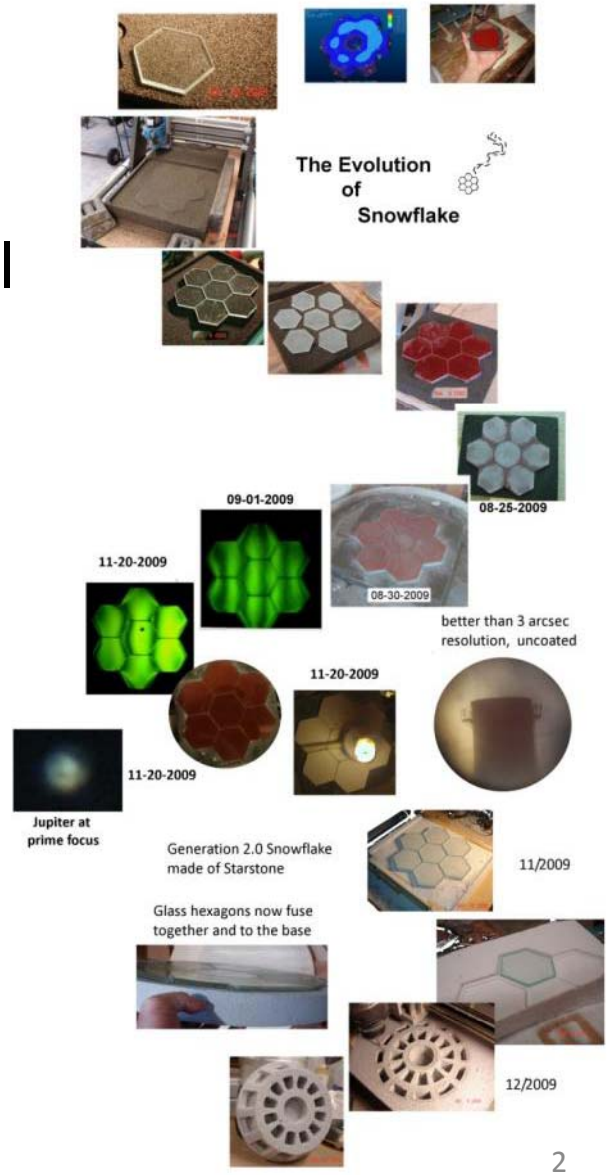
- A long time ago, in a swamp
  far far away… a snowflake fell
  and nobody heard it.



Reflections show a potato chip surface to the blank. Notice the reflection of the board on the left and the 'puddle' reflection of the paper roll on the right. This was an excellant fusion but the final curve made the puck unusable.



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- PPG Foamglas (the black crumbly glass foam stuff) simply could not stand up to the heat of the glass fusion process.

- Enter a ceramic product that is made from recycled glass, can be machined with diamond, survives fusion to sheet glass, and when made into mirror blanks can be worked much like solid glass mirrors.

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A few processing machines had to be built :

This is a 60” x 60” x 4” CnC mill that is capable of cutting the foam segments out of raw material blocks. Diamond brazed “tile cutting” roto-zip x-bits have to be used or the cutters will simply wear away in seconds upon contact with the foamglass.

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60” x 60” x 12”

CnC kiln for fusing of the sheet glass top/bottoms to the foam glass center sections.

Above is a few test mirrors in the kiln resting on ceramic tiles (on clay bricks). Left is an early look at the kiln coming together.

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60” dia grinding and polishing machine

These are early looks at the grinding machine. Most of the magic happens inside the wooden cradles that support the mirrors during grinding. They are designed to tip up and allow for fast inspection of the mirror surface without removal of the mirror.

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60” dia grinding and polishing machine with processing cradle

Most of the magic happens inside the wooden cradle that support the mirrors during grinding. They are designed to tip up and allow for fast inspection of the mirror surface without removal of the mirror.

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Already had the vacuum coating chamber for mirrors up to 60” diameter

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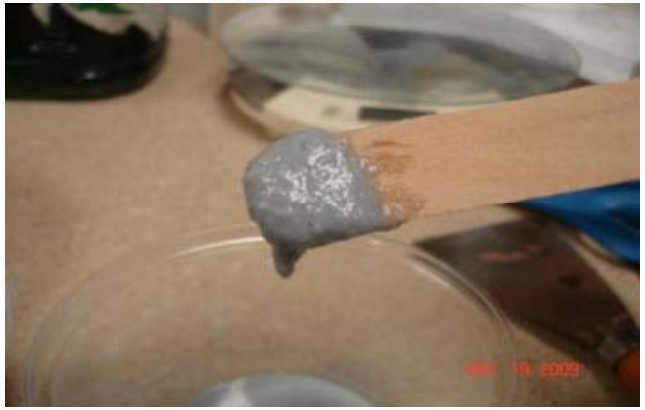
Early on, the learning curve was pretty steep. There was a lot of melted glass, broken foam and false starts that did not pan out.



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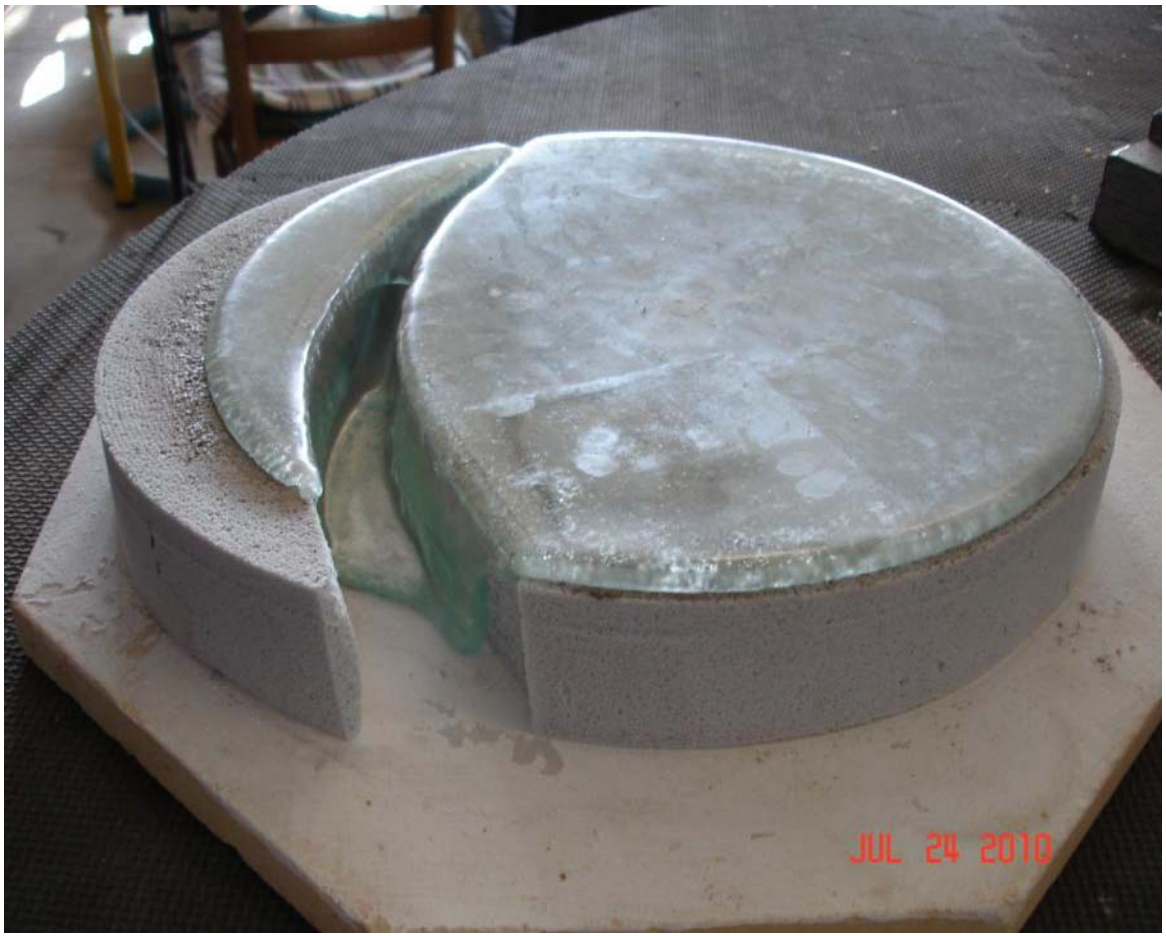
There were some exciting moments and a fair amount of melted glass involved. This is an example of taking the assembly up in temperature a little to fast. The glass can take a lot more thermal stress than the glass foam can.



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By late in 2009 the process of fusing glass to foam glass was starting to produce 9” test mirrors.

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During the 2010 Fringe Fest (late in February) experiments in grinding were getting going with “pickles” and beach sand.

Dave D in flowery shirt,
Drew A in front

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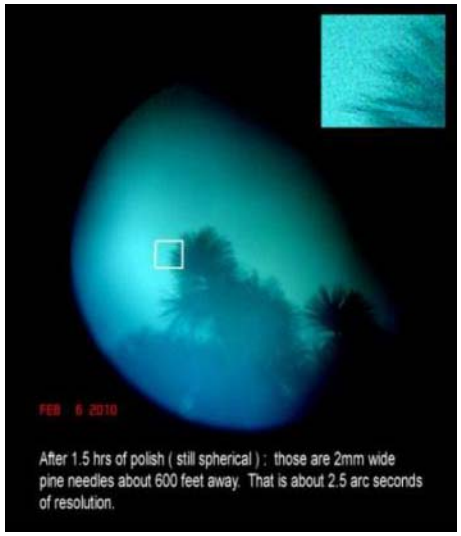
By the end of the 2010 Fringe Fest there were even some results to show off :_))))



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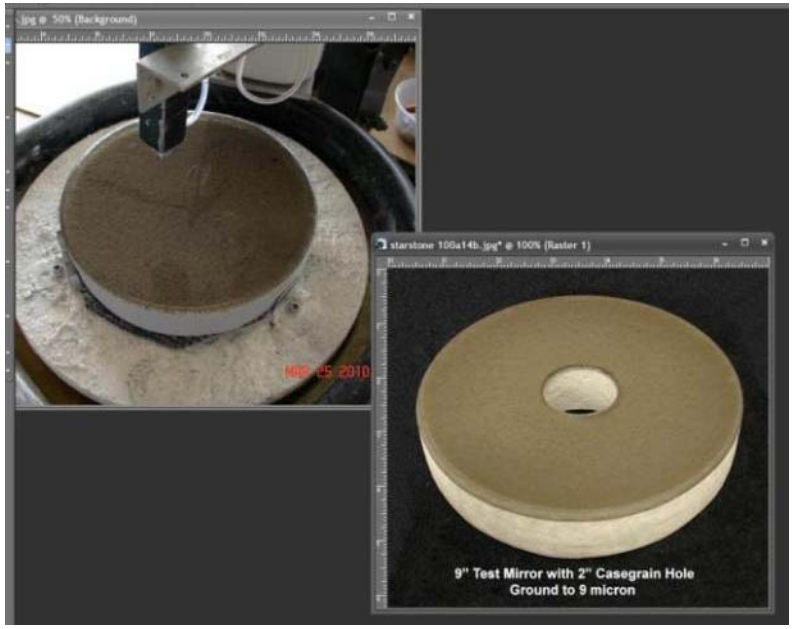
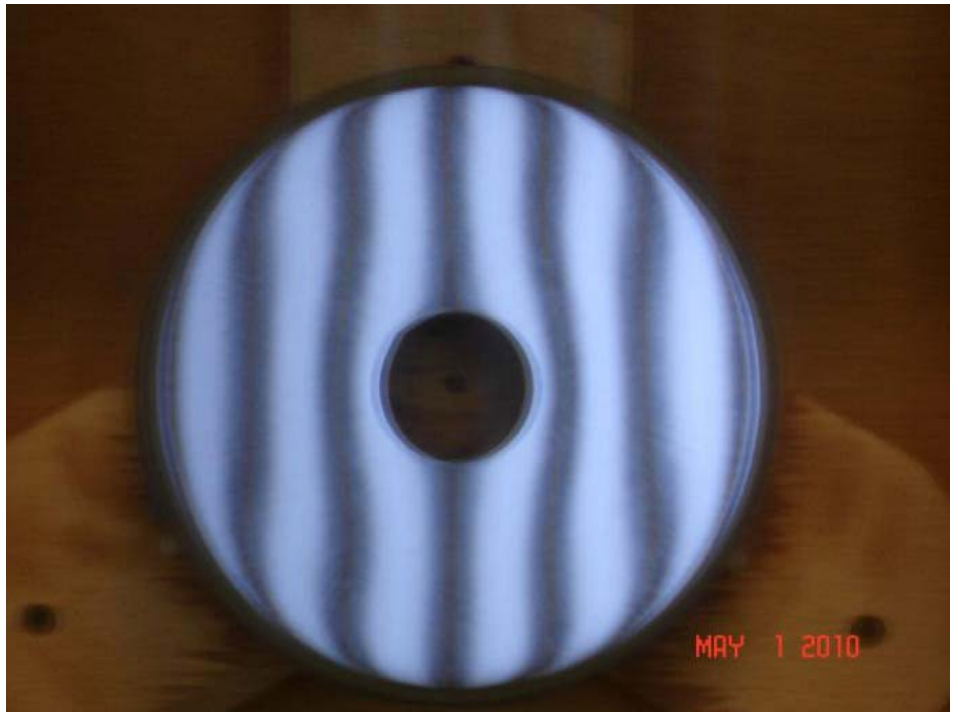
The next few months went by in a blur. Test mirrors started looking better.





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Serial Number #0001 was fabricated and delivered. It was a 9” x f/2 with spherical figure, but it floated.

Early blanks and tooling

Early test results

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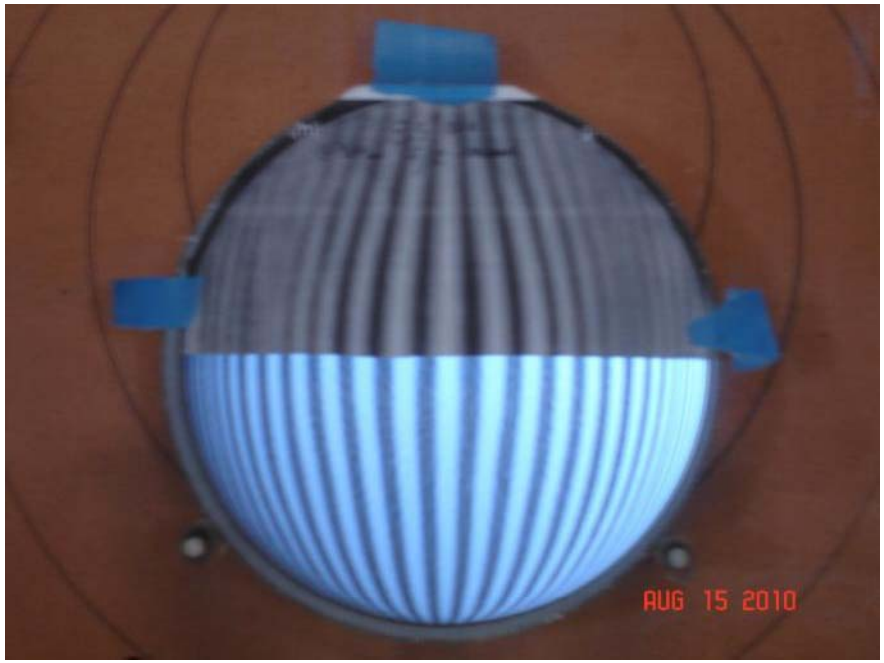
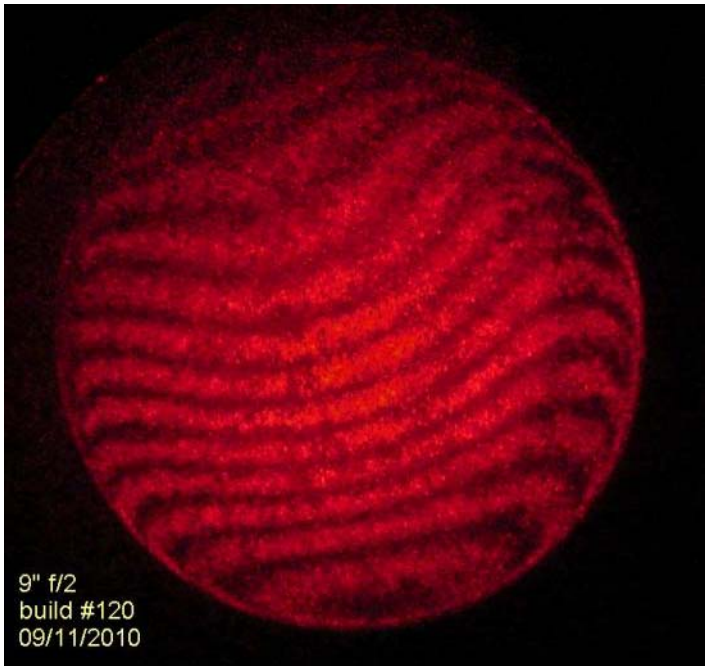
Ronchi grams are the preferred testing parameter.

Printouts of the ideal curve are laid directly on the mirror and the current state of figure is compared for accuracy.

Ingrams are the future……. but that is a whole nutter story



Ideal Ronchi gram on top, actual on bottom



BATH interferometer fringe Ingram

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Sadly, the core foam glass material only comes so big. Segmented cores were required. That was fun.

Like Di Vinci, one only has to remove the stone that does not belong to the mirror.

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Segmented mirrors got bigger.

The learning curve got steeper.

http://www.youtube.com/watch?v=ePkAYc2IOKU

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Persistence and dumb luck turned out to be our best tools.

Drew A. trying to scare a mirror into spherical compliance. Using a way to small grinding tool was a very bad idea.

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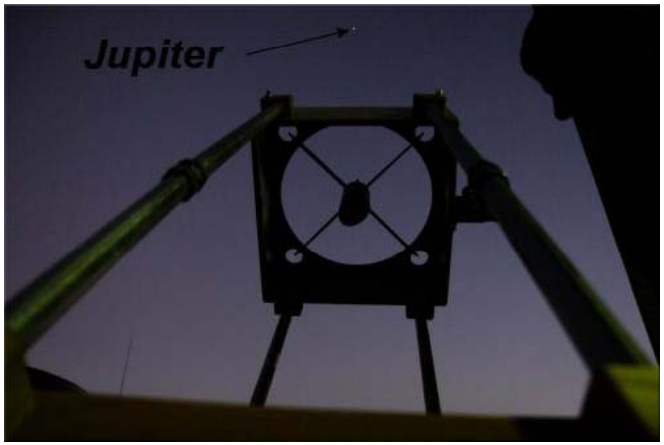
Star testing of the first 18” prototype in Nov 2010



Uncoated mirrors and lack of stardrive pretty much limited us to looking at the slow moving and bright targets ……. like Jupiter and Polaris.

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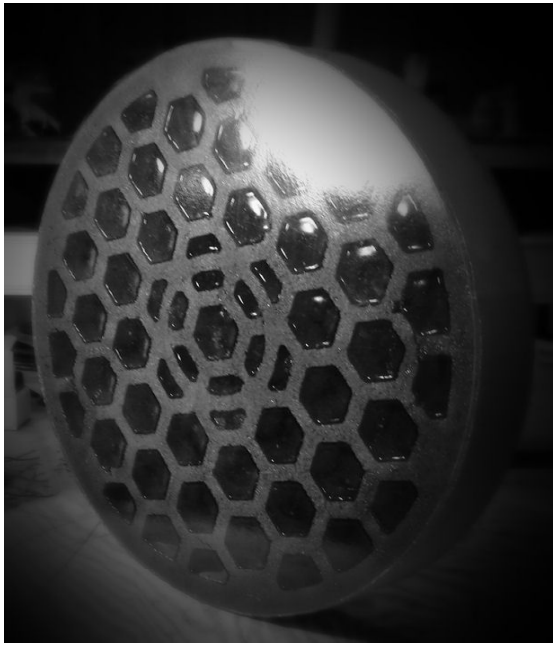
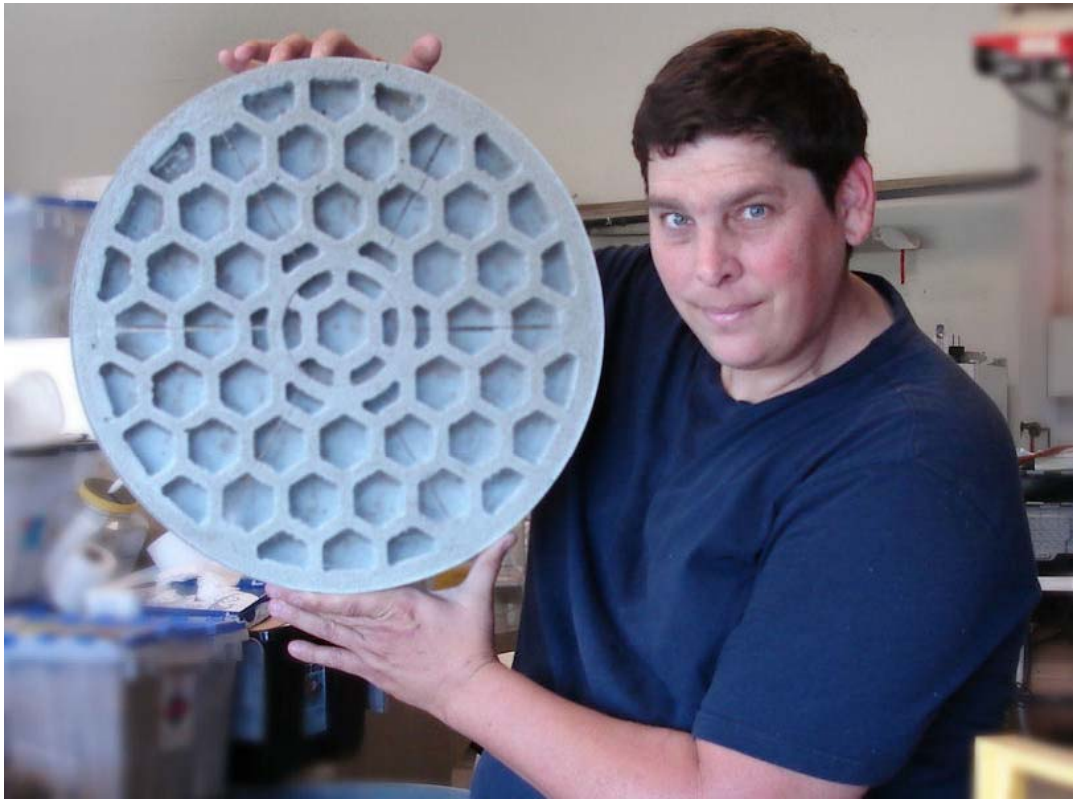


The shape of things to come ……



http://www.youtube.com/watch?v=BpMTlj-OQL4

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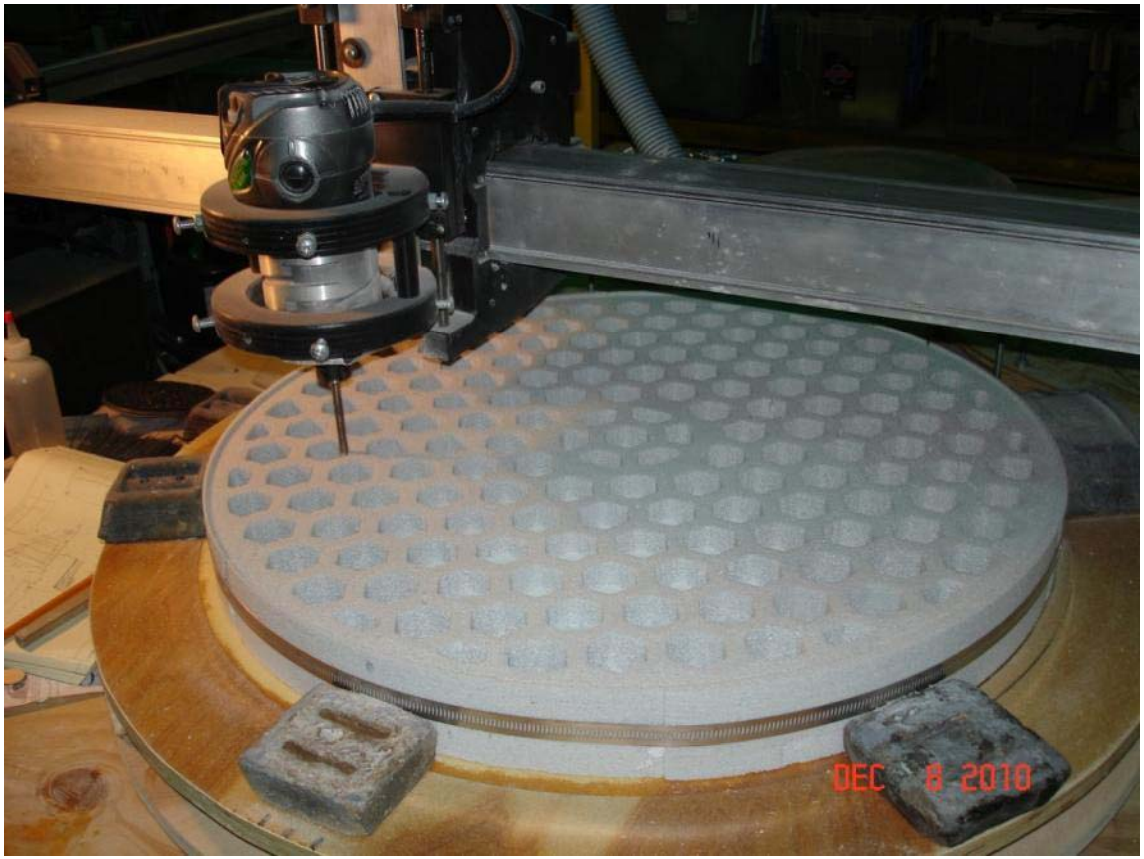

The first 25” prototype getting its rear face cut out of the foam primitive.

This blank is ready for the kiln as of the writing of this caption.

StarStone Factory update video 12/2010

http://www.youtube.com/watch?v=Qzm7J5rpLPQ