AUTOPSY

8" Saturn Shell

Manufacturer:	*Sunny*
Shell Weight:	*2737g*
Lift Charge:	*200g 3FA black powder*
Outer Burst:	*1363g BP on rice hulls*
Inner Burst:	*150g KP on cotton seed*
Ring Stars:	*5/8" dia. round stars*
Planet Stars:	*1/2" dia. round stars*
Hemi I.D.:	*6-7/8"*
Hemi O.D.:	*7-1/8"*
Case Thickness:	*3/16"*
Time Fuse:	*Dual chinese time fuse, 6 sec delay time*

Figure 1: Half containing ring stars and inner planet stars. Note the layers of tissue used to hold the planet stars.

Figure 2: Burst charge of KP on cotton seed loaded into planet stars.

Autopsy Report:
I was very interested to see the internals of this particular shell, since I have tried many times without success to produce a good Saturn shell. The concept is simple enough: A ring shell with an inner sphere of stars that produces a break looking like a planet with a ring around it. The trick, however, is getting a good spherical pattern for the planet that is also the right size in relation to the ring.

My own attempts generally involve loading a set of inner hemispheres with stars and then taping them together as if building a small shell. This shell is then inserted into one hemisphere of the outer shell, filled around with BP coated onto a coarse material like puffed rice cereal, then gluing in the ring stars with hot glue. The other half is filled solid with burst except for an indentation made with a hemi the same size as the inner shell. The two halves are then quickly slapped together and tamped closed.

The commercial shell shown here uses a much simpler method with no central container to hold the inner stars. A form is used to produce a cavity in the outer break charge, which is then lined with tissue and filled with a layer of 1/2" stars. It seems hard to believe that this would produce a good round inner break, since even my own encased planet stars tend to distort on the axis perpendicular to the seam between the two hemispheres.

Perhaps part of the key is the use of a faster burning KP burst charge inside the planet stars seen in Figure 2(coated onto cotton seeds) relative to the slower burning BP break charge used in the

Figure 3: 1/2" dia planet stars set into 4-1/4" dia pressed cavity.

Figure 4: 5/8" ring stars rolled in tissue. Note the spacer link.

Figure 5: Other half containing only the planet stars.

Figure 6: Digging through the 3 layers of tissue to get to the center.

outer layer (coated onto Chinese rice hulls). The ratio of size between the inner shell and the outer shell is also worth noting, with the inner shell being about half the diameter as the outer shell.

There is a belief that the distance a star travels from the center of the break is determined by the size of the star. I disagree with this theory and maintain that distance traveled is largely determined by the distance the star is located from the center of the shell. You can put very large comets just inside the star layer of a color break shell and observe that the comets never outrun the smaller stars in front of them. Thus, even if you use tiny stars for the planet layer, making the inner layer to big will cause the stars to follow closely behind the ring until the tiny stars burn out. The tiny star method also results in a planet that burns out too quickly. As can be seen here, a larger star is used and the inner petal is simply made smaller (4-1/2" O.D. in this case).

The ring was made in the typical Chinese method of rolling the stars in tissue paper as seen in Figure 4. Interestingly, the ring looks to have been rolled too short in this case and a spacer made from three additional stars rolled in tissue was required to fill in the resulting gap to complete the ring. I can't help but hear the phrase "no rice for you!" when looking at this repair job.

Looking at images 5 and 6, it is quite amazing just how much tissue paper can be piled up without causing a major fire block. Overlapping tissue from three separate liners pile into the center of each hemisphere, meaning that the fire entering one side of the shell must get through overlapping tissue from all six liners in order to ignite the burst charge at the center of the opposite hemisphere! Perhaps the porous nature of Chinese tissue paper makes fire transfer less of a problem, or maybe the extreme heat consumes the tissue so quickly that it's as if it wasn't even there.

It is worth noting once again that Chinese rice hulls are quite different from typical rice hulls used in America. Chinese hulls tend to be the full sized hull with the rice grain removed from inside. These hulls produce a nice football shaped grain that compresses very little when used for break charge, with lots of gap space to allow rapid fire transfer between the grains. American hulls are more like shredded flakes that produce a dense yet compressible break charge with less air gaps for flame propagation.

I have found that the compressibility of American type rice hull break charges is problematic in trying to keep the planet sphere of a Saturn shell from deforming. The use of puffed rice cereal break or even granular rough powder works much better and is a closer approximation to the characteristics of the rice hull charges used by the Chinese. While rough powder will work, it adds unnecessary weight and consumes more BP than is necessary. Puffed rice cereal is really the ideal substitute for approximating real Chinese rice hulls.