Build This...

2" Easter Egg Shells

August, 2002 Issue

Build This:
2" Easter Egg Shells

Design Notes:
Time Fuse and Spolettes

Tool Tip:
Cross Match Punches

Autopsy:
4" Canister: Color w/Strobe Reports

NEW! Shell Burst Simulator

Summary:
The use of plastic Easter eggs is a quick and cheap means for producing small shells that perform surprisingly well. While this type of shell is a good choice for first time shell builders, they also prove quite effective as rocket headings, girandola headings, multi-tube cake loads and even inserts for larger round shells. The oblong shape does not reflect itself in the break pattern, which tends to be more symmetrical than film canister shells or even paper canister shells of the same diameter.

Formulas: Whistle Mix

Materials:

- (1) 1-3/4" O.D. plastic Easter egg shell
- (1) 3/8" ID x 1-1/4" long thin walled paper tube
- (2) 7" long strips of fiber reinforced tape
- (1) 4" x 12" strip of 30lb kraft

Tools:

- 7/32" drill bit
- Cross match punch
- Hot glue gun
- Utility knife

Unmeasured Materials:
Time fuse, cross match, whistle mix, 1/4" to 3/8" stars.

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Figure 1: Drilling 7/32" time fuse hole.

Figure 2: Cross matched time fuse in place.

Figure 3: Center tube filled with whistle mix.

Introduction:
The use of Easter eggs for making small aerial shells is nothing new, as they are ideally suited for this purpose. Unlike film canister shells, which are another popular small I.D. shell made from the small plastic cans that film is packaged in, Easter eggs are easier to acquire in large numbers. Even though they are not perfectly round, the break achieved with them is comparable to shells made with commercial plastic hemispheres of the same size. While they are only on the market a few months each year, Easter eggs are typically sold in large bags for a reasonable price. The only difficult part is buying enough of them to last the whole year!

There are two types of plastic commonly used in Easter eggs: styrene and polyethylene. Styrene is a stronger, more brittle plastic that most Easter eggs were made from in the past and is ideally suited for making shells. Unfortunately, styrene eggs are getting harder to find. Polyethylene eggs, which are more pliable and slightly transparent, have all but replaced the styrene variety. Thus, the construction method shown here has been designed to achieve good performance using polyethylene eggs.

Construction:
The newer polyethylene eggs come with a small hinge that keeps both halves attached, which actually makes assembly a little easier. Begin by drilling a 7/32" hole into the bottom of the larger shell half, as seen in Figure 1. This size hole will provide a very snug fit for standard Chinese time fuse. Any burrs left from the drilling will need to be removed or it will interfere with inserting the time use.

Using a length of time fuse appropriate for your application, cross match one end with a 2" long stick of black match. If you will be shooting your shells from a small mortar, a length of about 1" between cross match holes will provide good timing. The second cross match hole is not punched until after the shell is completed. Twist the time fuse into the shell half until the cross match nearly hits the bottom, as seen in Figure 2. Care must be taken not to cut your hands on plastic burrs when doing this. After the fuse is positioned, use hot glue to seal around the external end of the time fuse. This helps insure that no hot gasses leak in around the sides of the fuse when the shell is under the pressure of lift or burst gasses.

A small paper tube made from a few turns of 50-60lb kraft around a 3/8" former is placed over the cross match and slid down onto the time fuse. The tube should be level with the rim of the shell half and does not need to be glued to the bottom of the shell. The purpose of this tube is to contain the burst charge as well as make sure the ignition point is at the center of the shell. Several tests on shells with and without the center tube indicate that it is an important component for achieving a good break pattern.

Figure 4: Round stars fill remaining space.

A burst charge of 70-30 type whistle mix is used to fill the inside of the tube, as seen in Figure 3. If the shell will not be used immediately, it may be a good idea to glue a small piece of tissue over the tube to insure that the burst charge does not migrate out of the tube and mix with the stars.

With the burst core completed, the remaining space is filled with the stars of your choice. The stars can be round, cut or even pumped, ranging in size from 1/4" to 3/8" depending on the effect desired. Figure 4 shows 5/16" round stars being used.

Once the shell is loaded, it is closed by quickly inverting the smaller half over onto the half containing the burst charge. Some tapping will be required to get the stars to settled and allow the seam to fully close. The stars should not be able to loosely roll about inside the shell.

It is not necessary to apply glue to the seam for holding the shell together, although a band of masking tape will help to keep the shell from accidentally popping open during assembly. The weak point caused by the seam is compensated for by two 7" long strips of fiber reinforced packing tape that wrap one complete turn around the shell as seen in Figure 5. The strips are applied perpendicular to each other so they form an X at each end. A utility knife is used to cut a small slit at the center of each strip so that the time fuse can protrude through it. These tape strips provide considerable strength in the long direction, preventing the shell from simply popping in half at the seam.

Figure 5: Fiber tape for longitudinal reinforcement.

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Figure 6: Rolling on two turns of pasted 30lb.

Figure 7: Pleating paper over each end.

Figure 8: Paper smoothed down and ready for drying.

Pasting:

There are a number of reasons why a few turns of pasted paper around this shell will improve performance. Polyethylene provides poor containment by itself, tending to easily tear instead of break into fragments. The fiber tape already in place helps fix this problem, but a paste layer further improves the containment needed for a symmetrical break.

If this shell is to be used as an insert inside of a larger shell, then the paste layer is absolutely essential. The high temperatures and pressure inside a shell prior to burst is not a friendly environment for plastic shells, as they tend to melt and pre-detonate. The pasted paper provides rigidity so that heated plastic can not collapse, and also provides an extra barrier for gas entry around the seam and time fuse.

One might also take note that this shell is not particularly attractive in Figure 5. A paste layer provides the benefit of hiding this ghastly shell from those who might cast a critical eye at your deviation from traditional materials!

This shell will still function without any paste layer when being fired singly from a mortar, although the break will be less attractive. Omitting the paste layer allows the shell to be fired immediately, which is useful for quickly testing a batch of stars or even to satisfy a pyro fix when you have no product on hand. In this case it is necessary to put a band of masking tape around the seam prior to applying the fiber tape in order to prevent lift gases from getting into the seam and causing a flower pot.

Pasting in this shell need not be a labor intensive ordeal involving strips, as is the case when pasting larger round shells. The shell is simply rolled in two or three turns of thin kraft as if making a canister shell. The ends are then torn into tabs and pleated down to seal both ends, as seen in Figure 7. The use of recycled kraft actually helps the paper lay down better without effecting the performance. If the shell is to be used as an insert, then more than two layers may be required. The larger the shell is that will contain the inserts, the longer the inserts will be exposed to high temperature and pressure prior to being thrown from the shell.

Once the shell is pasted and dried, the time fuse is punched and cross matched. Figure 9 shows the punch described this month being put to use.

If you wish to fire your egg shells one at a time as stand-alone shells, Figure 10 shows everything you will need. Rather than attach the lift and leader to such a small shell, it is easier to prepare small lift packs using tissue paper to hold your lift powder. A mortar is bottom fused with a piece of raw black match, then the lift pack is dropped into the tube, followed by the shell. The shell can be oriented with the fuse on the top or the bottom, it will ignite either

Figure 9: Punching crossmatch hole after case dries.

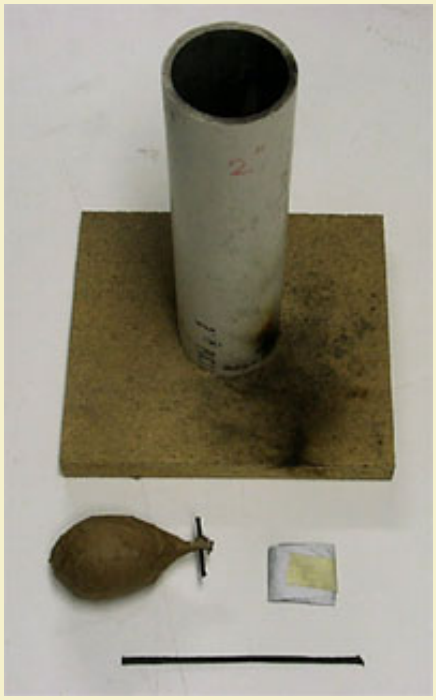

Figure 10: PVC mortar, lift pad, black match and shell ready for testing.

way. The black match will burn through the tissue paper and ignite the lift, which should be between 8 and 10 grams of 4FA for this particular shell. The lift can be weighed out and packaged into small squares so that there is only a single layer of tissue around the powder. Black much must be used with this method, as visco does not provide enough side spit to burn through the tissue reliably.

When firing successive shells, be sure all sparks are extinguished before loading the next shell. Stubborn sparks can be removed by throwing a handful of sand into the mortar and swishing it around before dumping it back out.

The mortar shown here is a 10" long piece of 2" PVC that is plugged with wood at the bottom. This mortar should not be used to fire salutes of any kind, as a misfire would send PVC shrapnel in all directions with the potential for severe injury. Star shells do not provide enough force to detonate a PVC mortar, but cardboard or HDPE is still recommended as the safest type of mortar to use.

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