**Tool Tip...** **Page 1**

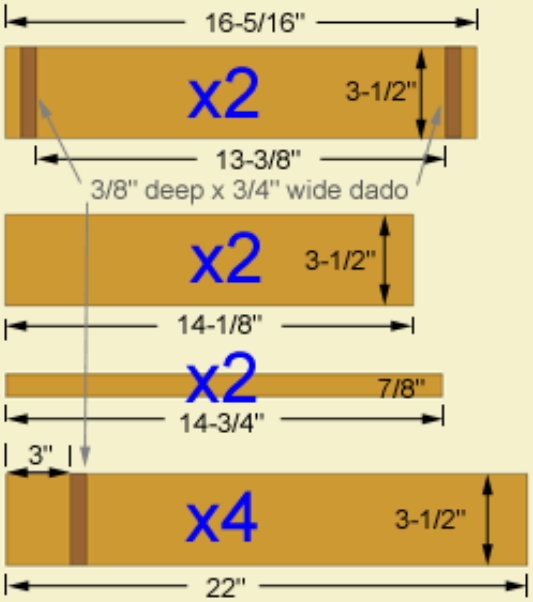
# Mass Rocket Launcher

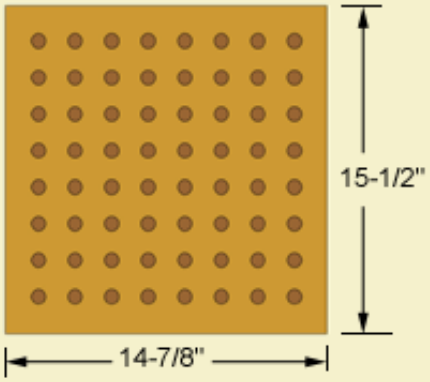
Figure 1: A configurable multi-rocket launch pad.

**Introduction:**
The idea of shooting many rockets in a single volley is certainly nothing new. Pyro literature as far back as Thomas Kentish's 1887 publication of The Pyrotechnist's Treasury makes mention of a wooden box with an array of holes in the bottom used to fire a "girandole of 100 rockets at once." George Weingart goes into a little more detail on a similar box in his book Pyrotechnics, with two sets of perforated plates parallel to each other such that the rocket sticks pass through both boards in order to keep them straight. In both examples the top board is covered with a layer of meal, onto which the primed rocket nozzles rest. Both designs called for a lid that could be closed over the loaded rockets in order to protect the bare meal from accidental ignition until they were ready to fire.

While the above mentioned fixtures are a good way to produce flights of rockets that occur virtually all at once, the rocket launcher described in this article is designed to allow a slower, more regulated progression of rockets one after the other. The rockets can be fired in a sequential progression, in volleys of up to 8 at a time, or in a pyramidal progression in the order of 1, 2, 3 etc. until 8 is reached. This firing order is determined by the routing of raw blackmatch fuses into slots in the sides of PVC guide tubes. Much like the fusing of a cake item, the flight of one rocket will ignite any blackmatch protruding into the rocket's launch tube when it fires. Thus any progression that can be fused into a cake item can also be duplicated with this "rocket cake" fixture. This launcher requires that all rockets be fused with black match, so most commercial class C rockets would have to be refused in order to work with this launcher.

The fixture described here was designed specifically for the 1/2" black powder rockets described in this month's Build This article, and can hold up to 64 rockets. Figure 1 shows the completed launch stand, which employs 64 segments of 6" long PVC pipe glued into a solid, removable block. The wooden



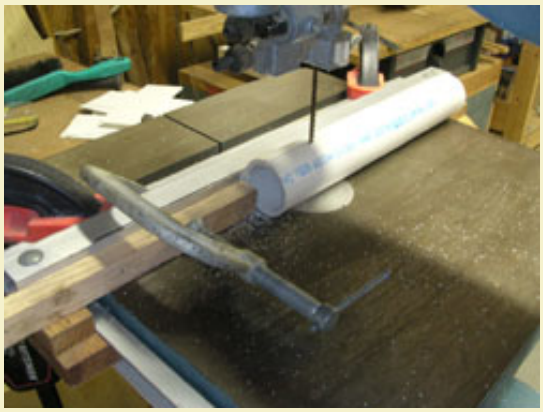



Figure 2: Cutting the passfire slots using a band saw.

stand supports this tube array such that the rocket engines will be seated about 1.5" into each tube. Because the loaded rockets actually rest on the bottom plate, an adjustable bottom plate would make for an improved design. The fixed design shown here is set for a 24" long rocket stick fastened to a 4" long engine.

**Construction:**
Most of the work in building this project is in fabricating the 8 x 8 grid of slotted PVC tubes. The tubes used here are 6" long segments of 370 psi white PVC measuring 1-5/8" O.D. The inside diameter doesn't matter, but the outside diameter will determine the dimensions of the box and bottom plate if your pipe is not the same O.D.

The first step is to cut all 64 segments and clean out the burrs and rough edges. Next you will need to make 2" long slots at one end, which should be roughly 1/8" wide. This is easily done if you have a band saw by using the setup shown in Figure 2. The fence is clamped so that the blade contacts the tube about 1/16" off center. A stop block is clamped 2" back from the cutting point in order to keep all cuts the same length without making measurements.

The tubes are pushed into the blade until hitting the stop block, then removed and rotated 180 degrees and cut again. This gives you both cuts of the slot, as seen in Figure 3 (blade guide raised for visibility only, don't cut with that much exposed blade). The easiest way to remove the slices of PVC is to just pull them out until they snap off, as seen in Figure 4.

Of the 64 tubes, 16 of them will need two sets of slots perpendicular to each other, while the other 48 only need one set of slots. The double slotted pipes are used as the outside rows on opposite sides, so that the fuse chain will be able to turn the corner and head back down the next row. The inside rows are just straight progressions that don't allow turns, so only one entry and exit slot is needed. While every tube could be given a double set of slots, which would result in more fuse routing patterns, this creates the added risk of gasses blowing through the slots and igniting adjacent rows out of order. Using only the minimal number of slots necessary helps insure the launch progression goes as planned.

**More...**

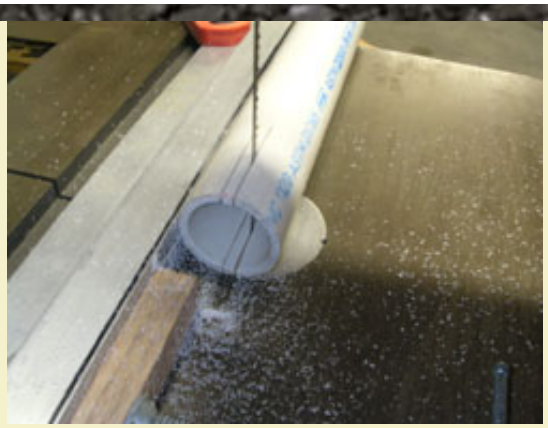


Figure 3: Fence and stop-block are used to control spacing.

Figure 4: The 1/8" tabs are broken away by hand.



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Figure 5: Joing details of the container frame.

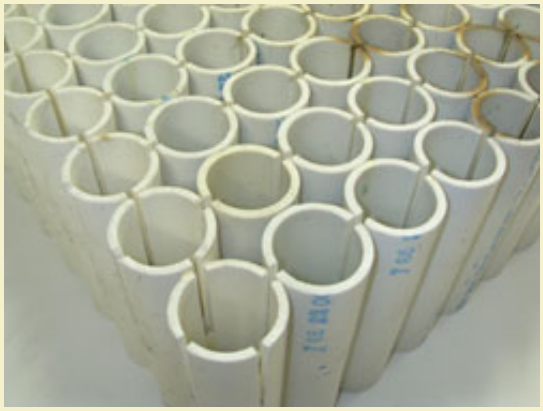


Figure 6: Closeup of passfire slots in finished tube grid.

Figure 7: Using a centerpoint guide to mark the hole positions for the bottom plate.

Once all 64 slotted guide tubes are prepared, the next step is to build the box that will frame them. The box is sized so that the tubes will pack snugly into the frame, which will be used to hold them together during the gluing process. Be sure to trial-fit all the tubes into your frame to be sure they will fit before starting to glue them together.

To glue the tube array together, use PVC cement to run a bead down the side of each tube that will connect to the side of another tube. Work inside the wooden frame, placing single rows at a time. Start with a double slotted tube at one end, followed by six single slotted tubes with the slots running in the direction of the row, then finish the row with a double slotted tube. Figure 6 shows how the slots are arranged in the finished block.

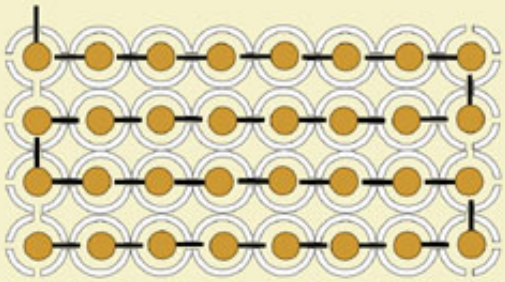
Once the glued block of tubes has dried, it can be used as a guide to mark the stick holder holes in the bottom plate. Place the tube block over the bottom plate as seen in Figure 7, then use a 1-1/4" dowel with a nail or drill bit centered at one end to punch a center mark under each tube. The bottom board is then drilled out using a 1/2" wood bit at each mark, making sure not to drill more than half way through the board. These holes will keep the bottom of the rocket sticks from sliding around once the launcher has been loaded.

Figure 8 shows the bottom board inserted into the dado slots located 3" up from the bottom of each leg. The top ends of the legs are fastened to the sides of the tube box, as seen in Figure 9. The last step is to place the 7/8" wide strips of wood along the left and right bottom edge of the tube box, which serve to create a thin shelf so that the tube block can not drop through the holding frame.

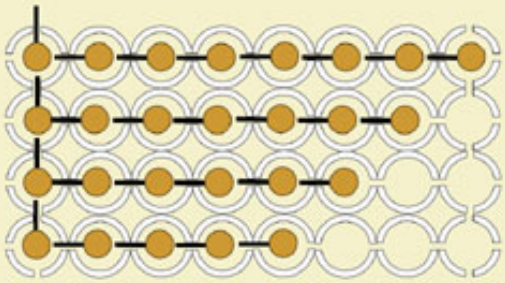
**Firing Configurations:**
The loading diagrams below illustrate some of the possible sequences that can be created. Only half of the available launch tubes are illustrated in order to save space, but the patterns shown can be extended to use the entire tube array if you are so inclined to make 64 rockets!

Figure 8: The stick support plate mounted into the leg channels.

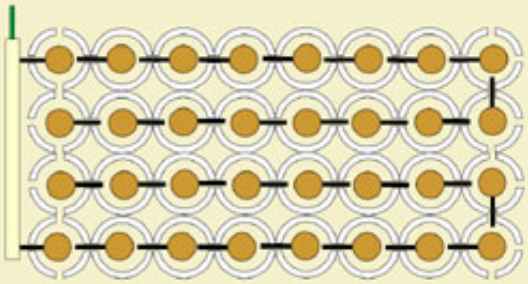
Figure 9: PVC support blocks visible on left and right edges inside the box.



A simple single-fire progression that launches rockets one after the other.



A pyramidal firing sequence that starts with one rocket, then two, then three until four is reached. This pattern is more effective when it is extended to use all eight rows, so that the progression builds up to eight instead of four. Note that empty tubes are left at the back end of the progression in order to prevent a reverse pyramid sequence at the end.



A double-fire sequence that fires pairs of rockets at once using two simultaneously ignited single fire progressions. Note that quickmatch must be used to ignite two separate chains at once. The same concept can be extended to produce as many as eight parallel rows firing at once.