Modifications to a Harbor Freight style blaster.

There are two parts to this story. Modifications to the top and those to the bottom. Let us start with the top.

Top.

I always wheel my blaster outside of the workshop when in use. There is always some media spilt when blasting and I do not want any of it inside. This created a problem with this blaster though. The top with its large viewing area was close to horizontal and I would get reflections from the sky, or even worse, the sun when it was high. These reflections made it difficult to see what was happening inside the blaster. Sometimes I would throw a coat over my head as a light shield but that could get hot and stuffy very quickly.

The picture clearly shows the near horizontal window which gave reflections from the heavens.

Some quick experiments with a small sheet of glass showed that laying it back about 30 deg. from vertical eliminated all troublesome reflections. So I built a new top to hold the glass at that angle. I know that the safety conscious will question the use of glass, but I get fed up with continuously replacing plastic alternatives. I hate a less than perfect view and glass lasts a long time before losing its clarity. If you copy this, then please use toughened or safety glass.

I discovered many decades back when I had a large commercial blaster that large windows are not necessary to get a full view of any workpiece so I planned on a smaller window. Tests with a hole cut out of a piece of cardboard soon showed how big it had to be.

I do not think that it is necessary to go into constructions details of the new top except to say that it was made from MDF which had a hard coating on one side, Formica or similar stuff. The hard side went

inside. The near vertical window gave more clearance above the working area and I never hit the gun against it. With the original window I was always hitting it in the more limited space. The glass is held in place with some easily removed pieces which allows a very quick window change.

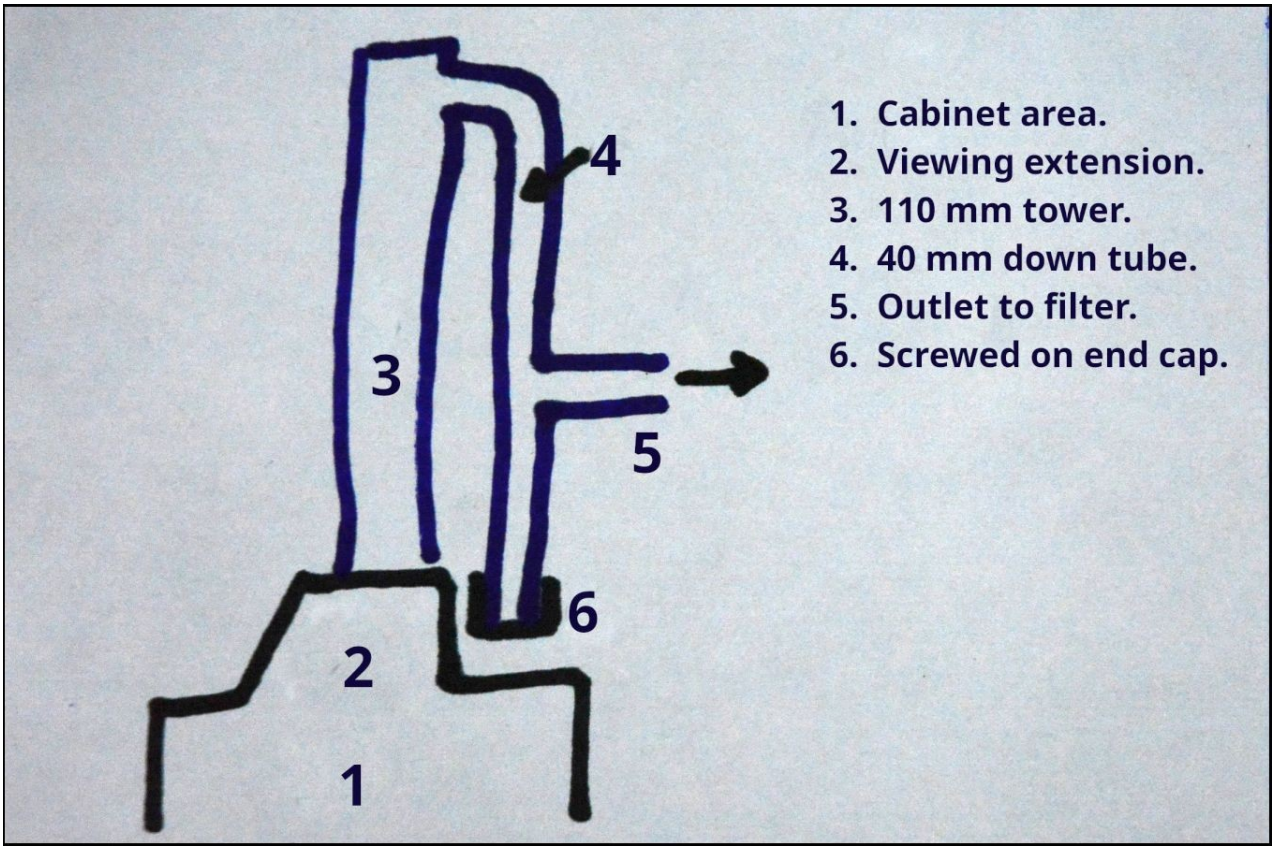
Although the camera has picked up some reflections on the window there are none visible when standing directly in front of it.

A clear window with no reflections is only part of getting good visibility, good lighting and good dust extraction are equally important. For the lighting I use two LED lights mounted externally to the cabinet which is sealed with small disks of polycarbonate. The lights themselves are fitted into short lengths of waste water plastic pipe, and just lift off for replacement.

On the left is one of the polycarbonate windows viewed from inside the cabinet, on the right we see the light housing.

These modifications made a huge improvement to the ease of use of this cheap blast cabinet, but the more interesting work concerned the ventilation and dust extraction which involved a little bit of science. On top of the new window housing I added a tall circular tower, made from a piece of 110 mm diameter pvc tube for the dust extraction, open to the cabinet at the bottom and closed at the top. Near the top of this tower is an open connection to a smaller tube which runs down the rear of the blaster. A little over halfway down this second tube there is a T junction which passes out to the dust trap and small shopvac. Finally, at the bottom of this tube is a screwed on cap from a dirt trap for a kitchen or bathroom sink.

Showing the large diameter tower with the smaller diameter down tube and shopvac connection. There is a short connecting tube near the bottom of the tower, this is a structural support for the down tube.



Diagrammatic side view of dust extraction system. The function of each part is explained in the following text.

The basic requirement is to extract as much dust from inside the cabinet for both clear visibility and waste removal. In this process we want to retain as much of the good blasting media within the cabinet. The principle behind this design is that the relatively heavy media will drop out of slow moving air by gravity whereas the dust will tend to stay suspended in the air for much longer.

Let us consider the numbered parts in the diagram:

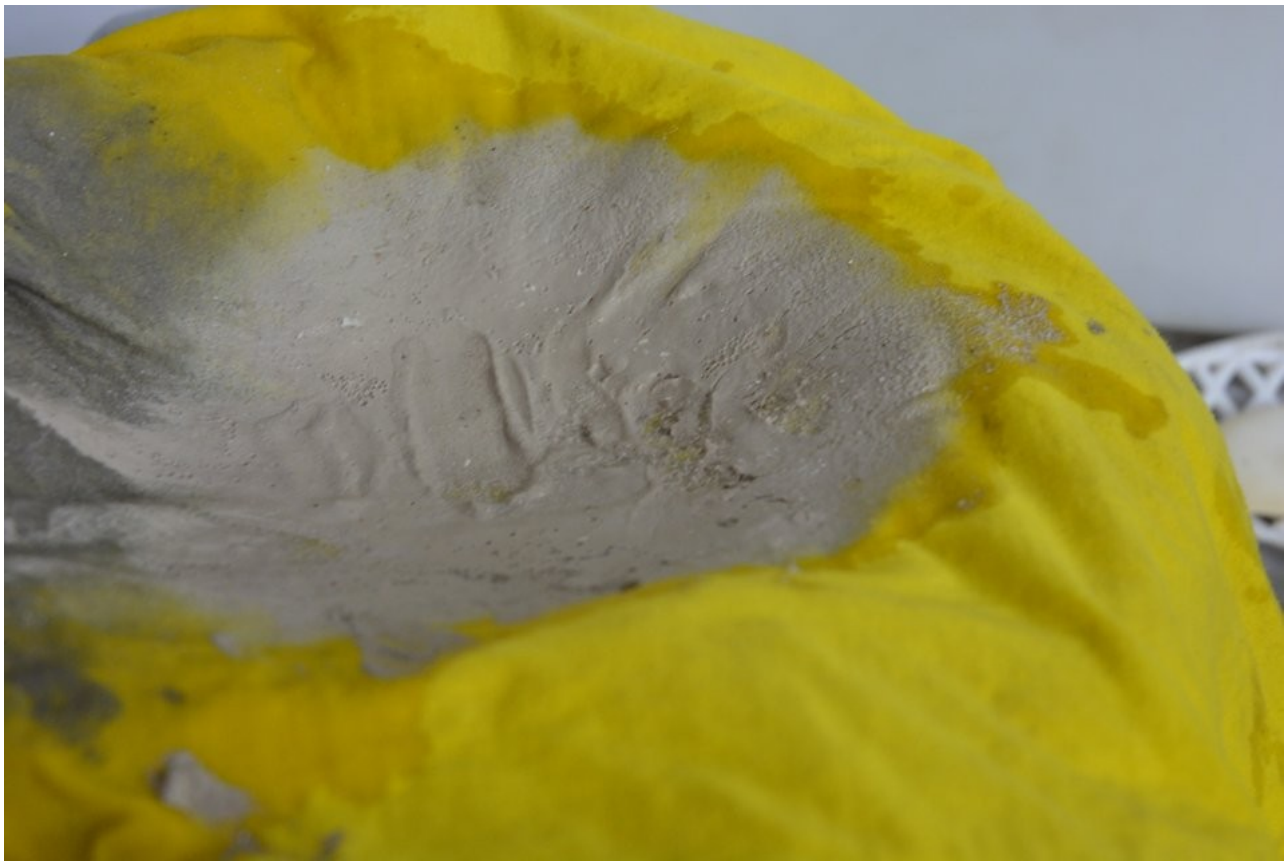
1. Cabinet area. Here both media and dust will be swirling around. Air enters the cabinet through the blast gun from the compressed air inlet and also through a hole to the open air which is covered by a filter. The extraction system must be capable, at a minimum, of flowing at least as much air as forced in with the air supply.

2. The new window area as previously described. The extraction flow will be upwards in this area but the flow velocity will be low and most of the good media will drop out.

3. The main tower. This is of large diameter (107 mm internal) which keeps the extraction flow velocity relatively low. The height of this tower gives time for the vast majority of the remaining good media to drop out of suspension and fall back into the cabinet. The velocity is high enough to keep the lighter dust in suspension.

4. The drop tube. This is 37 mm ID. Giving a velocity ratio of 8.4:1 compared to the velocity in the tower. Combined with help from gravity any remaining media particles will accelerate to a relatively high velocity and will go straight on past the outlet T piece (5) landing in the cap (6) at the bottom. The lighter dust will tend to follow the airflow out through the T piece to the water filter and shopvac.

It works perfectly, as well as my most optimistic hopes. After a long blasting session there is very little media and no dust caught in the end cap and the water filter only contains dust from broken media pieces and the stuff removed from the workpiece.



Residue from the water trap after a blasting session. Only fine dust, there is no sign of media particles.

Water trap

The tower system works so well that there is no need to use a cyclone to remove the larger media particles and cyclones are not great for 100% dust removal. So I made a water trap to catch the dust. Even though I had baffles in the water, designed to break up the large bubbles into small bubbles, the water would bubble up out of the container. I solved this by making the trap quite tall with only a low level of water in the bottom. I once tried putting some detergent in the water to reduce surface tension, to help wetting the dust. I only tried that once because it sshad the surroundings submerged in foam, very quickly. Anybody remember the film “Mr. Roberts” with Jack Lemon and James Cagney?

The water trap consists of a large plastic tube containing several baffles and a discarded plastic paint bucket which contains around 3 litres of water. The small silver thingy on the back of the cabinet is the filter for the air inlet to the blaster to increase the air throughput above that of the compressed air inlet.

The shopvac sucks from the top. The inlet tube from the blaster extends to about 20 mm from the bottom of the bucket and the flow exits through a baffle to break up large bubbles to smaller ones which gives a larger bubble surface area which increases the dust transfer into the water. There are several baffles inside the large tube to prevent water splashing all the way up to the outlet.

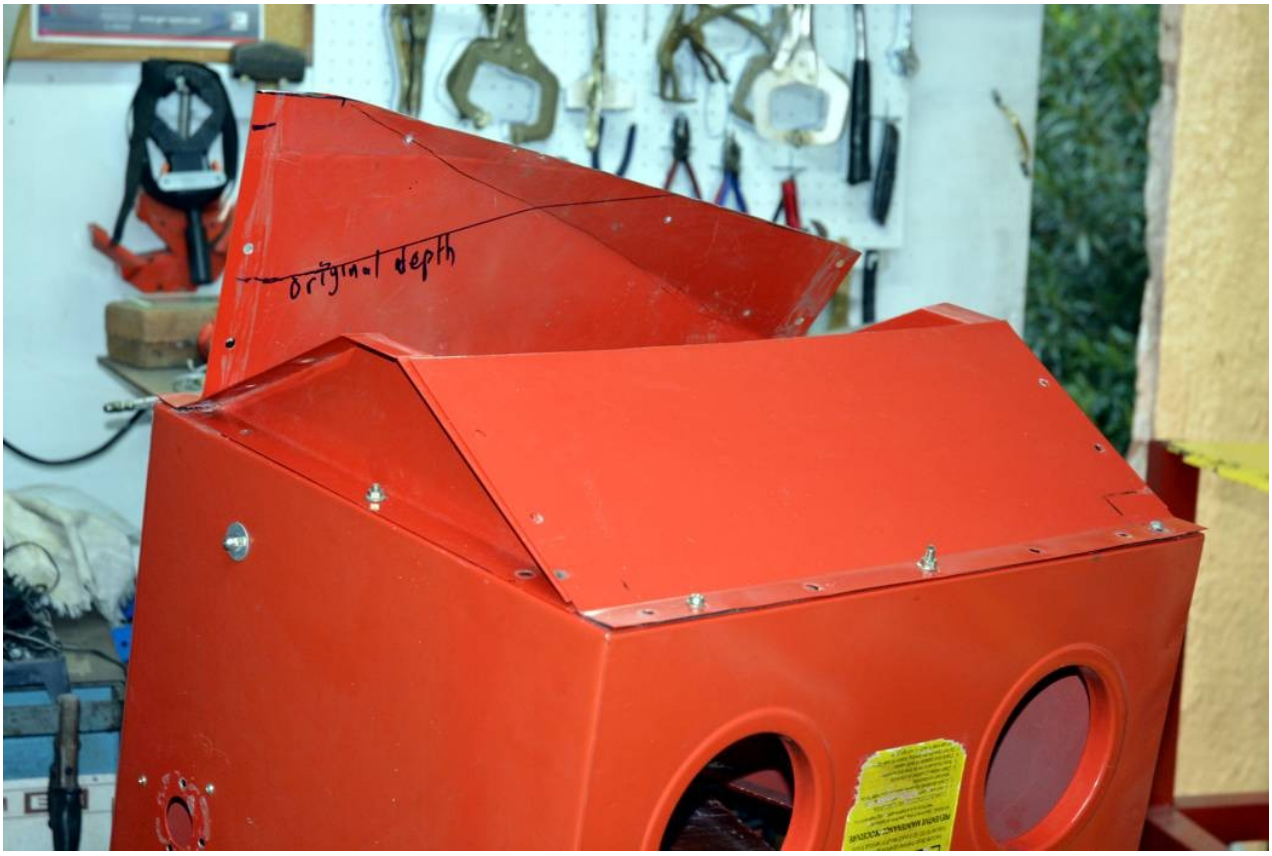
Baffles in the water trap, the trap had to be tall to keep the water in, otherwise it would just bubble up and pass through to the vac.

Bottom

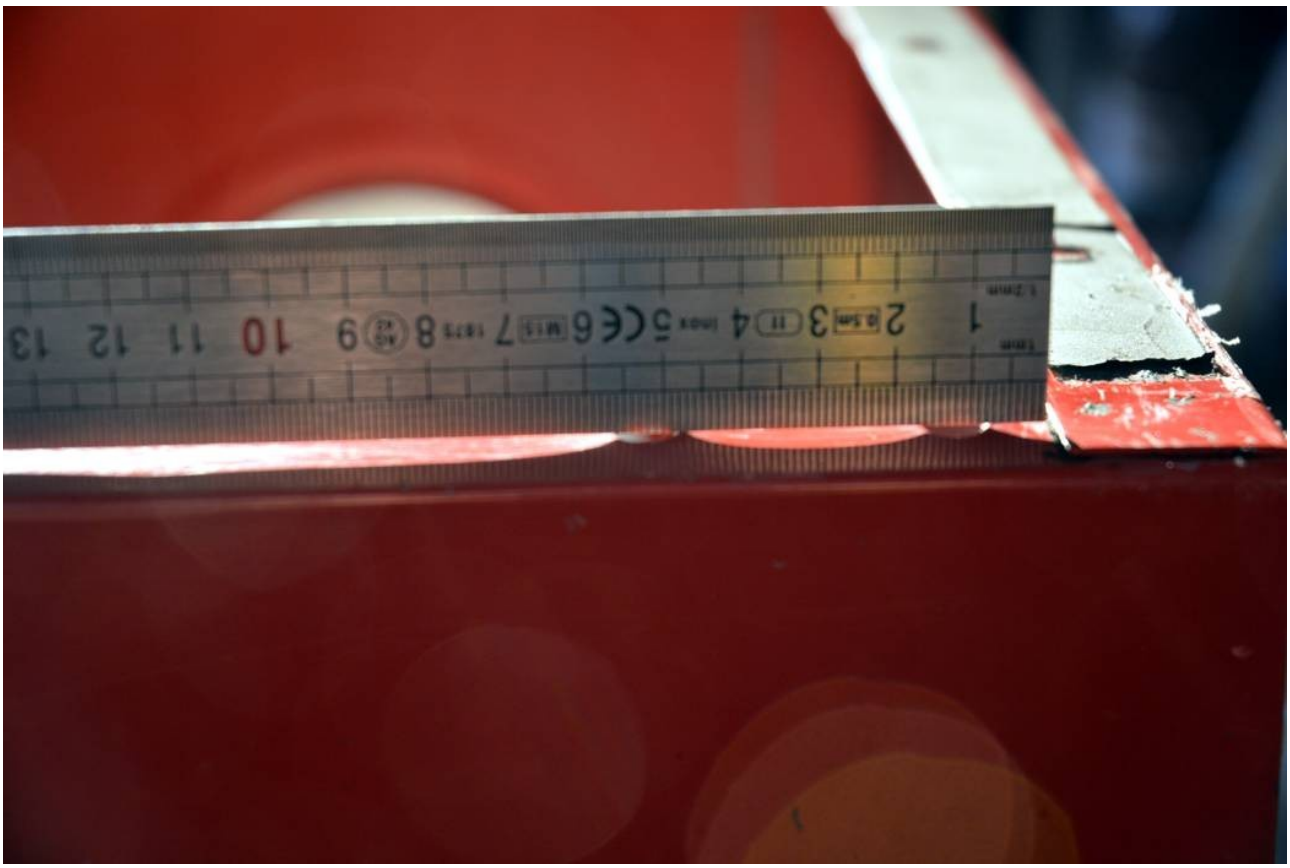
As we have seen, the low profile top of the original blaster caused problems. The bottom had very little depth and caused an addition problem. The sides of the hopper were too shallow and the media did not fall to the bottom very well, starving the pick up tube of media. Other blasters have deep, steep sided hoppers.

The previous photo and this upside-down photo clearly show the shallow hopper.

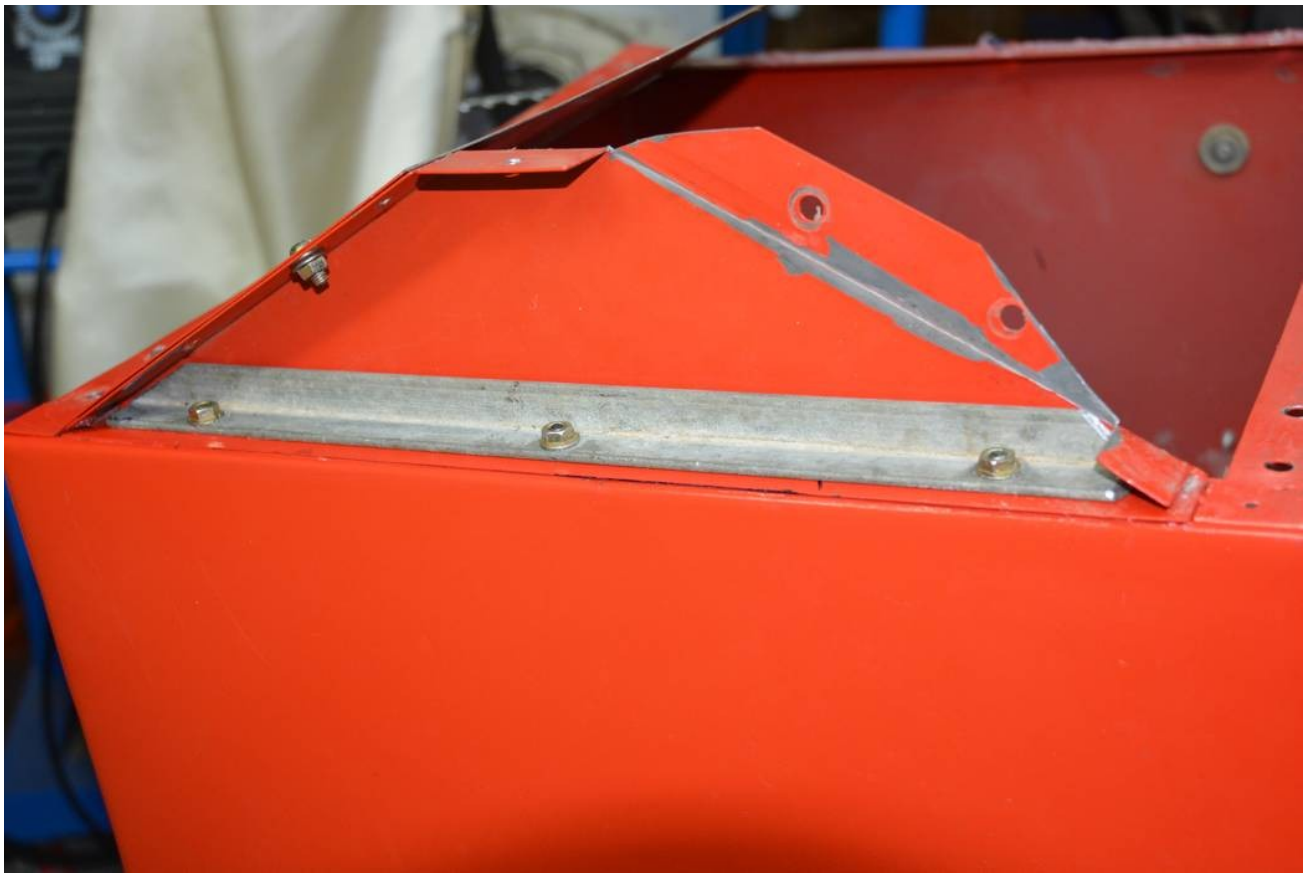
I modified the hopper to be deeper. I cut and bent some of the original and then added more steel sheet to achieve this. Here are a bunch of photos without further explanation.




WARNING



The hopper was bolted to the cabinet with a soft gasket between the two, with the inevitable result that significant deformation occurred. You should only use a soft gasket on surfaces that are strong enough not to distort like this.



I hammered the surfaces flat and used some angle and flat strips of 4 mm thickness as a backup to eliminate the previous cause of the distorted bolt holes. I used silicon sealant in place of a soft gasket. The silicon will just squeeze out of small gaps and stay in place to seal any larger gaps without applying significant distortion causing forces.

Compare this modified hopper with the original. It works much better now. Note the ball valve to allow easy draining of the media.

What would I do differently?

Given another chance to do this I would not change anything to do with the new viewing port nor the dust extraction system. I just do not see how I could improve those things.

The water filter works fine but I might look into a more compact approach.

Blasting with the new hopper is a huge improvement but it is not quite perfect. Some media still tends to stick to the sides where they are not steep enough. If I were doing it again (which I am not) I would make a new hopper rather than modify the original. It would be deeper and have all four sides steeper with a central low point.