

**Subject: EM-38 PVC Tail / Sled Design**

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## **1. Introduction**

This report contains a visual description of how the GEBJ Salinity Laboratory designed and fabricated an EM-38 tail-sled component for the Lee Spider Spray Trac vehicle. The purpose of this report is to document the PVC tail-sled system, so that other interested parties can copy, modify, and/or improve on this design.

Figures 1 and 2 show the complete, finished PVC tail-sled unit. This unit represents the third piece of 3 components; a boom / hoist system (for lifting the PVC tail), a tail-mount platform (for holding the PVC tail in place), and the PVC tail / sled unit itself. This report described how this third components can be fabricated (the design of the boom / hoist system and tail mount platform is discussed in a separate report).

## **2. Fabrication of the PVC "Dog-tail" Extension Apparatus**

The PVC tail is actually comprised of two separate components; a "dog-tail" extension piece and the sled itself. The upper end of extension piece mounts to the tail-mount clamp (visible in Figure 1), and the lower end attaches to the sled unit. This extension piece is quite easy to fabricate using standard 6 inch PVC tubing. It consists of the following components: a 56" length of 6" tubing, a 15" length of 6" tubing, two 45 degree 6" corner pieces, and one custom made 4" PVC pulley. All of these pieces are glued together to create the dog-tail extension.

Figure 3 shows a close-up shot of the PVC pulley. We created this 4" pulley out of 3/4" flat PVC material, and created the groove using a lathe. The clamping device which supports this pulley was made from flat 3/8" PVC material (heated up and formed into a circular "clamp", as shown in Figure 3). The "bolt" was created from a 1" PVC rod, and the "nuts" were also hand made.

Figure 4 shows how the sled unit normally attaches to the dog-tail, using five 1/2" PVC bolts (these are commercially available). These bolt holes should be drilled and hand-threaded after both the dog-tail and sled unit have been assembled, so that the two pieces line up properly.

### 3. Fabrication of the PVC Sled

The majority of the work involved in creating the tail-sled system is associated with the construction of the sled unit itself. Figure 5 shows two sled units; the left unit is attached to the dog-tail extension, the right unit is unattached. The right unit also has the inner soft-foam cushion removed (the upper end of this cushion can be seen in the lower right hand corner of Figure 5).

To create a sled, you will need the following material: a 56" long piece of 6" PVC tubing; a 6" cap; a 16" piece of 1.5" tubing, a 1.5" "t-connector" and flat connector, two 4 foot long 2 by 4's, 4 feet of 1/2" plastic rod, a small amount of 3/4 flat PVC material, and about 48" of soft foam circular cushion (or similar suitable material). You will also need a hand jig-saw (for cutting out the opening in the 6" PVC tube).

The first step in the construction of the sled is to rough cut the opening for the EM-38DD instrument. This opening should be about 44" in length, with approximately half of the tubing removed. We've found that tapering each end of the cut at about a 45 degree angle works best (with respect to structural stability).

The sled is designed to skid along the ground, using the 2 by 4 material as a "ski". Figures 6 and 7 show how we chose to attach these 2 by 4's to the underside of the tube. We first carve a crown molding into the inner 2 by 4, so that it fits up flush to the underside of the tube. We then drill 5 evenly spaced 1/2 holes (10 inches apart) completely through this 2 by 4, and glue it to the tube. Next, we round the ends of the second (outer) 2 by 4, drill the same 1/2 inch holes, and then counter sink these holes (1 inch deep) using a 1.25" drill bit. This second 2 by 4 is designed to bolt up against the inner 2 by 4 using 5 PVC nuts attached to 1/2" threaded rods (see Figure 7). Note that as this outer "skid" wears down, it can be easily replaced.

The cutting and mounting the 1/2 threaded rods (through the underside of the tube) is done manually. Figures 8, 9, 10, and 11 show how we achieved this, using small pieces of 3/4" PVC material glued to the inside of the tube. Note that each rod is also glued to the same 3/4" material (so that it can not twist free). A second set of longer threaded rods (which extend upwards from the inside base of the tube) are also glued into place at this time (see Figures 9, 10, and 11). These two sets of double rods will ultimately be used to fasten down the EM-38DD unit, once the soft cushion is in place. We used 6-inch circular packing foam for our cushion. This sort of material can be easily cut into the correct shape, and dropped into place over the threaded rods.

The next step is to mount the 1.5 tubing (with the t-connector on top) to the front of the 6" tubing. This "riser" will be used to elevate the EM-38DD cable away from the end of the instrument. At this point you will also need to perform some custom cutting along the sides of the 6" PVC tube (so that the EM-38DD instrument knobs clear the side of the tube). Additionally, you will need to fabricate up the flat brackets and nuts used for holding down the instrument (these are visible in the top part of Figure 10). We

generally recommend that you buy your EM-38DD before creating your sled, since this allows you to custom fit your instrument to your specific sled design.

#### **4. Summary and Conclusion**

Figure 12 shows a completed sled unit, with an EM-38 DD instrument placed along side it. Figure 13 shows how the instrument fits in and attaches to this sled. Note that in this figure the sled is attached to the dog-tail, and the EM-38 cable has been routed through the t-connector. (Note: this picture was taken on an earlier unit, where the dog-tail did not use a PVC pulley.)

When you are towing your Sniffer Rig, you should remove the sled unit. In turn, this will allow you to hoist up the dog-tail section up to the boom, as shown in Figure 14. This takes the majority of the weight off the u-joint, and also allows you to secure the dog-tail section to the boom while traveling. This also minimizes the amount of PVC tail extending beyond the rear end of your trailer.

## Document Figures (1-14)



Figure 1. Side view of the PVC tail sled system.



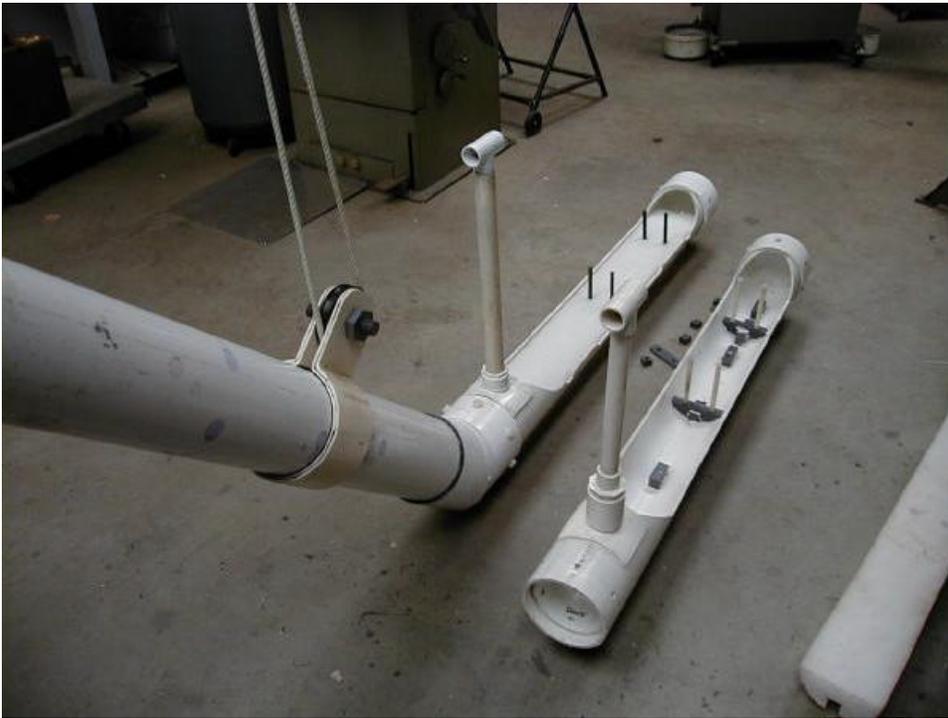
Figure 2. Side view of the detachable sled unit.



**Figure 3. Close-up image of the PVC pulley used on the dog-tail extension piece.**



**Figure 4. Close-up image of how the sled attaches to the dog-tail (using 5 PVC bolts).**



**Figure 5. Two identical sleds (left unit attached, right unit standing free).**



**Figure 6. Side view of wood skid (forward section).**



**Figure 7. Bottom view of wood skid.**



**Figure 8. Inside view of sled (forward section).**



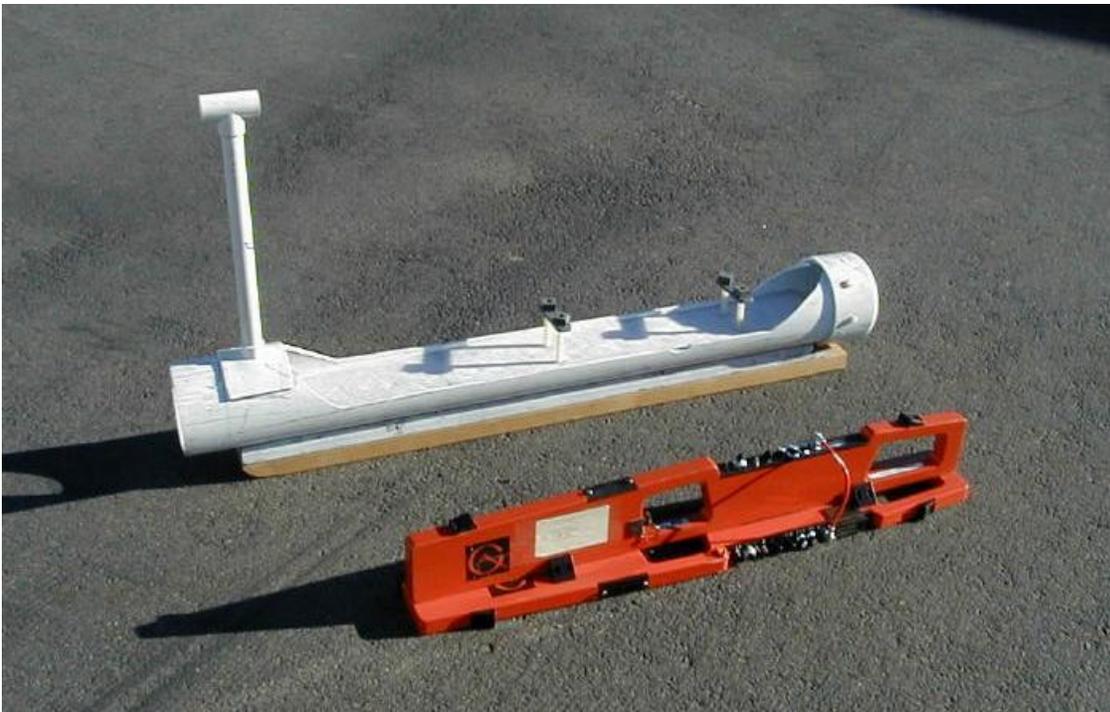
Figure 9. Inside view of sled (center section).



Figure 10. Inside view of sled (rear section).



**Figure 11. Close-up view of one set of EM-38DD attachment rods.**



**Figure 12. Finished sled with EM-38DD placed along side the sled unit.**

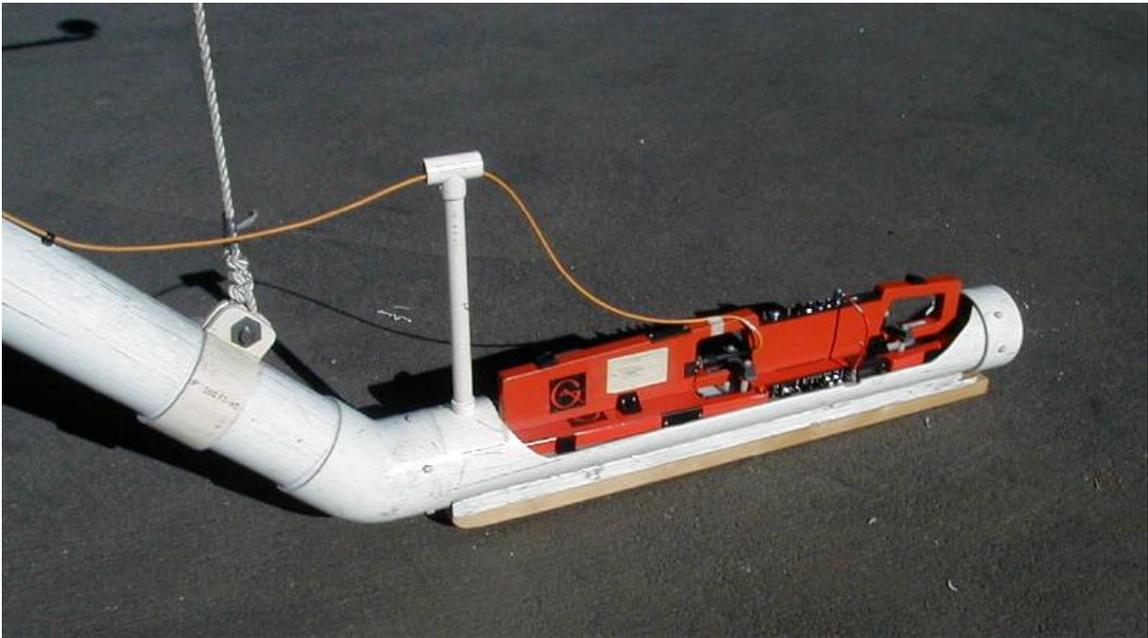


Figure 13. Finished sled with EM-38DD inserted inside sled unit.



Figure 14. Hoisted, secured dog-tail extension; ready for travel.