The Kitty “Go” Box – Not what you think

Reading the various material on HSMM Mesh, there has been talk of having a “go kit” for rapid node deployment. Here in the Virgin Islands, emcomm is especially important as we do not have the option of evacuation. Where would we go anyway? As I volunteer with the local emcomm agency, the idea of having a load of nodes available for rapid deployment is very appealing.

I have seen some photos of outdoor nodes that others have built using commercially available weatherproof containers. For permanent outdoor applications, these are undoubtedly the way to go. Being a ham, of course I’m cheap and didn’t relish the idea of spending lots of money for containers, even the gray PVC ones.

We have eight cats and for the last couple of years I just could not bring myself to throwing out the great little plastic containers that some brands cat food and kitty litter come in. I liked the way the stack up conveniently with the notches in the bottom of the containers. To store them, all you have to do is remove the lids, and they nest inside of each other perfectly. Here’s a sample of what’s out there.

DESIGN GOALS

Let’s see, what does this thing need to hold & what are the design goals?

- Weatherproof
- House node & twin omni whip antennas
- Weatherproof cable feed-throughs
- Battery backup
- Solar panel to charge battery
- Solar panel charging regulator
- DC fan for heat exhaust
- Ballast of some type. (Rocks are cheap!)
- Pipe mount base for larger antenna?
- In keeping with ham mantra ➔CHEAP!

I socialized my idea with a few other non-ham mechanically inclined friends who thought I was nuts and didn't really understand the mesh thing, but they still rendered a LOT of valuable feedback and ideas. I grabbed a kitty litter container and a node & started pondering the next steps.

As I discussed it with my XYL, W4LIS, she thought it was cool that something so simplistic could invigorate my creative juices so much! She's used to years, and years, of crazy ham DXpeditions, contests, towers, antennas, etc., so this wasn't anything out of the ordinary… She kind of understood what I was talking about, but regardless, but was very supportive anyway.

Tidy-Cats 35 lb. container

Top view

Inside view

I liked the containers with the hinged top as I figured this would be a good place for the node whip antennas to protrude. Similar to other outdoor enclosures, I figured I'd put the whips inside of weather tight PVC that protruded from the container. Unfortunately, when I put the node & the 9 dBi whips inside of the container; they were a bit too tall to fit inside of the container. Minor detail…

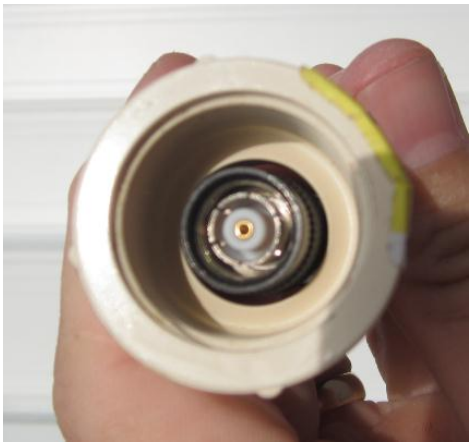
ANTENNA RADOMES

OK, enough fantasy visualization stuff. Time to make the rubber hit the road…. I went to the local hardware store and took a whip with me. First I checked out what size of PVC the whip would fit inside of. The whip was just a bit fat for ¾" schedule 40 PVC. I then checked out ¾" CPVC. For those of you unfamiliar with CPVC, it is a version of PVC that is used for water systems and has a distinctive dirty yellow color when compared to regular white PVC. Bingo! Perfect fit.

I bought a bunch of CPVC stuff (threaded adapters, tee's, pipe, etc.) figuring I'd use them like tinker-toys to find the best configuration. My idea was to make feed-throughs with threaded adapters. I found a threaded adapter that had a washer in it. When the washer is removed, the whip will easily slide through it.

Inside of container w/thread outside

Exterior threaded adapter



Whip goes through easily!

All right, time to get into some REAL building… I set the node on top of the container and eyeballed the best place to make the holes for the whip radomes. Rulers? We don't need no stinkin' rulers… Hey, this is a prototype anyway!

Alignment of whip antenna holes

Making pilot hole

Drilling hole (1.5" bit)

Nice clean holes!

A little hard to thread, but in!

Now for the cap!

OK, let's put the node in it and see how it fits. Whoops! Whips are too long so they have to be dropped through the feed-thoughs and screwed into the node, while it is inside of the container.


Don't forget to make sure that the base of the whips are oriented correctly so the node can be rotated to a horizontal position inside of the container!


OK, I am so proud of my accomplishment that I parade my creation around to the 'advisory team' who, still thinking I'm kind of nuts, provides more valuable feedback. Similar to the whips, I plan to use the same feed-through techniques for external cables.

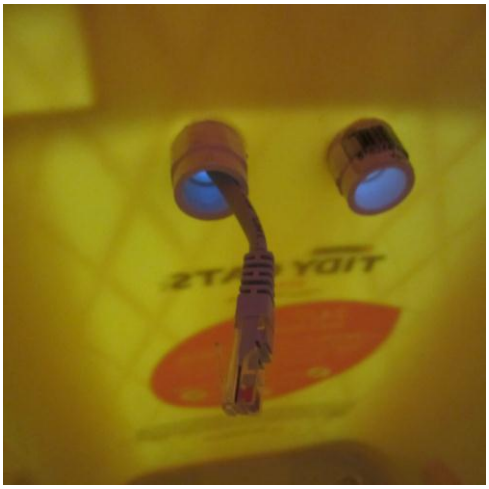
CABLE FEED-THROUGHS

I grab a threaded ½" PVC adapter (white ones) and luckily a large RJ-45 connector just barely fits through it. I select the side of the container under the whips for entry point. This would allow for a minimal amount of cable to be inside of the container. I figured that a couple of entry ports should do it. (Caps can be screwed on unused ports) To weatherproof the feed-throughts I figured on doing one of the following:

- Stuff something (saran wrap, cotton, insulation?) in the feed-through
- Tape around the connection after the cable was passed through

- Seal the connection permanently with by putting silicon rubber (aka RTV) in the connector (requires to permanently have feed-through 'mounted' on the Ethernet cable





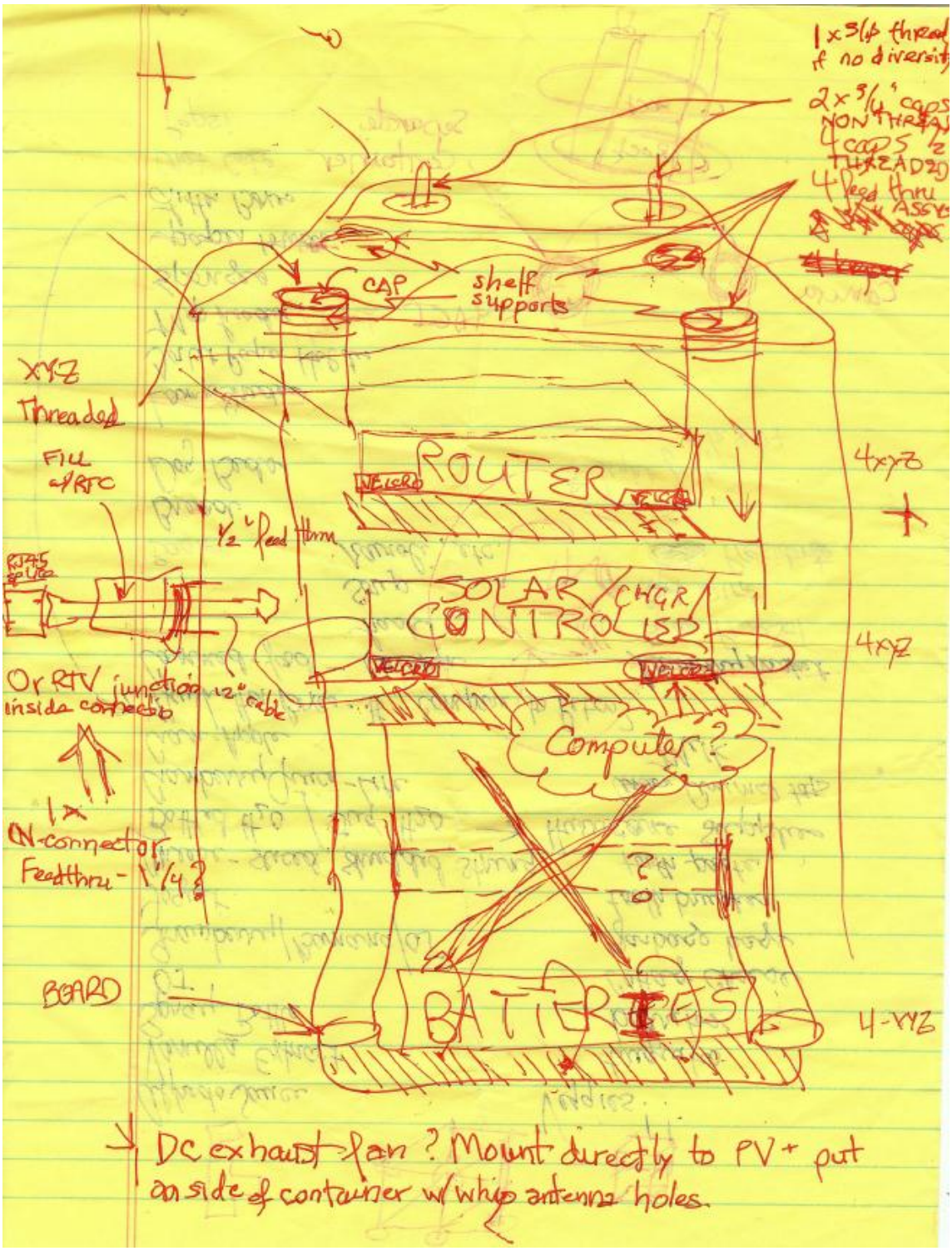
I happen to see the ¾" CPVC feed-through sitting on the top of the container and wonder if more than one cable might be able to fit inside of a larger feed-through. One, two, three, and finally four cables can be inserted in a larger feed-through. GREAT! I just saved some more precious product design budget by only needing a single cable feedthrough.

EQUIPMENT CAGE DESIGN

I now start thinking how to construct the cage that will hold the equipment. I take a couple of left over ¾" CPVC pieces and put them on either side of the node & position it inside the container. I try a couple of ½" PVC pieces. No way Jose! Not enough play on the side of the container. Have to find something smaller.

My gearhead buddy John suggests using 1/8” tubing (used in chandeliers for support & to run AC cable to light) for the equipment support rack. When I mention the requirements for tee’s and the like to my friend, that one goes out the window. I tell him I am more partial to PVC as it’s cheap and fairly easy to fabricate into what we need.

While sipping an adult island beverage, actually a few of them, my buddy Wess, K2AHU and I began discussing the equipment rack for the soon-to-be famous “Kitty Go Kits”. I found a scrap piece of paper and our whiteboard design activities were in session. “Bartender, another bottle of engineering fluid please…”



In The Beginning…. All good ideas begin with a plan…

Concept? Check. Building material? Ummmm… Back to see the guy at Home Depot. I find an 'associate' in the hardware aisle and walk up to him and say, "Boy am I glad to see you." I must have looked like a total idiot walking up to him with my cute little kitty container. I comment, "You look like a guy who likes a challenge." He looks at me (probably thinking I REALLY am nuts!) and calmly says, "How can I help you?"

I explain the mechanics of what I am looking for and fortunately he used to work in a section of the English military dealing with this battlefield comms. He 'gets it' and thinks it's kind of cool. Now he's really curious and anxious to join the design team.

I explain the need for a smaller diameter equipment cage material. He says, "Let's take a walk". We go back to the PVC area where I have now been several times. We walk to a section of CPVC parts & pipe which is separate from the other CPVC stuff. "Of course" I remark as he shows me the ½" CVPC 'tinker-toys'. While the regular ½" PVC would not work, due to CPVC's thinner walls, it would be exactly what I need to keep this project back on track!!!!

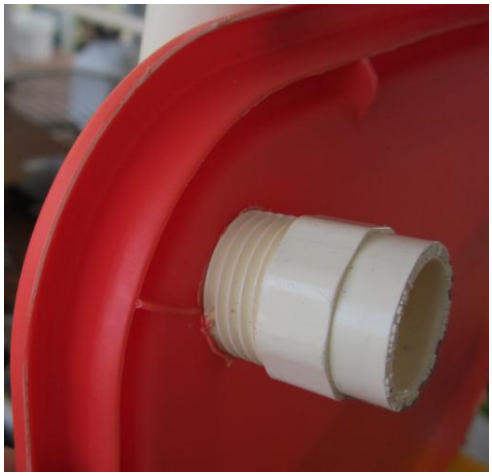
It's not immediately intuitive how to mount the node. Peter, KP2US tells me about a wall mount that's available for the particular LinkSys router, but they're something like 8 or 9 bucks each. Bzzzzzzt. Have to keep the mantra of 'cheap' at the forefront of design! My thoughts go to using velcro squares and/or loops of velcro that go around horizontal support bars.

EQUIPMENT CAGE FEED-THROUGHS

Again I use the eyeball method to layout the feed-through supports. I hold the node inside & outside of the container. I finally come up with the ole 'X' marks the spot design philosophy and crank up the drill. I am careful to leave enough room for clearance from the lip that runs around the periphery of the feed-through top. The clearance is needed in order to allow the hexagonal cap to turn. Later I find that the clearance isn't that important as the red plastic is fairly malleable.

I find that drilling in this plastic isn't as clean as the other holes. After drilling the hole, the plastic pieces need to be 'de-burred' with small knife. While the feed-throughs are more difficult to screw in, shaving off a bit more plastic around the rim of the hold make it possible to easily screw them in.

De-burring plastic hole



Screwing in feed-through

Top mounts for equipment rack

EQUIPMENT CAGE CONSTRUCTION

I get out the ruler and start cutting pieces of the newly acquired ½" CPVC. Note to self, 'even though you don't have a sprinkler system, one of those handly little PVC cutters would save a LOT of time'. So noted… Hey, this is pretty simple! Just like putting a sprinkler system together, only no valves, and on a smaller scale.

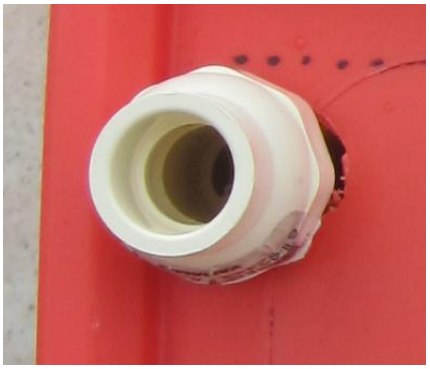
OK, looking good right? Whoops! Mr. Design Engineer, in his infinite wisdom forgot to account for the diameters of the feed-throughs in cage member lengths. (Of course I didn't measure anything, but it still sounds good!) Unfortunately Mr. Wise guy can't even come close to putting the node in the top shelf of the rack. I put in some longer CPVC pieces to accommodate for this, and now the shelf won't even fit into the container!!

Forget the proverbial drawing board, we're far enough into the construction phase that I elect to just cut & fit until I get what I want. I get the ruler out and determine what pipe lengths will just fit around the node. (Yes I actaully did measure this time! hi hi) I also had to modify the position of my original holes by carving up the plastic with the knife.

Taking shape

Carved up corner #1

Carved up corner #2



Carved up feed-through…

One thing that was kind of a pain is the fact that the container tapers a bit at the bottom. This necessicated some precision measurements to determine what lengths of tube to use.

OK, if you've read this far, then I guess you're really interested. Well, here she is in all of her glory! I'll pick up the rest of the story after I get the rest of the guts installed and then make a 2nd one to get all of the pipe lengths documented.


WARNING
AVISO

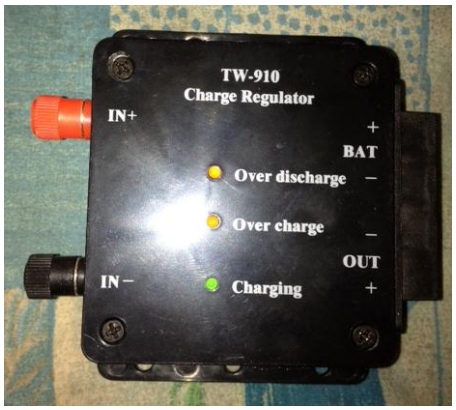

SBA
GS
Valve Regulated Lead-Acid Battery
RECYCLED
Pb
FLAME RETARDANT 94V-0
JAPAN STORAGE BATTERY CO., LTD.
MADE IN CHINA


GS
Valve Regulated Lead-Acid Battery
PORTALAC
PXL12072
12V 7.2Ah
NONSPILLABLE
BATTERY
MUST BE
JAPAN STORAGE BATTERY CO., LTD.
MADE IN CHINA

MISCELLANY

- PLASTIC LID - The red plastic lid doesn't sit straight because the holes I have drilled in are actually 'craters'! I believe that in a version where snug holes are drlled, it will look more level. Note that when out of the container, the lid will flex in weird configurations, but when placed on top of the container & snapped down, it is sung and level.
- RIGHT ANGLES – One other thing I neglected to acocunt for is the fact that the container tapers in diameter from the top to the bottom. Through trial and error I found the right lengths of pipe that would create the proper taper. I was REALLY glad I had CPVC as it's fairly forgiving on rigidity.
- BATTERY SHELF – I am thinking about cutting a piece of lexan with rounded corners to fit around the tees. Standard spade lugs will connect the battery (or batteries) to the PV charge controller
- PV CHARGE CONTROLLER – I have not done any research into this. My gearhead buddy showed me a solar powered motion-detector secutiry light that had all of this together. I think said the whole thing (light, PV panel, controller and battery) was something like $65 @ Home Depot. I will investigate this!
- COOLING FAN - I was going to intsall a low RPM small 5 VDC fan that is used in computer aplications. I would wire it up directly to the PV so it would run whenever the PV had enough excess power.
- OTHER SPACE – You can see there is still some open space in this thing. Depending on the size of the PV controller unit, there might be space for one of those little mini-PCs I saw in one of the Austin mesh guy's presentation.
- BALLAST – I thought we'd throw a brick, or some rocks, in the base of one of these things to keep it from blowing over in the wind. If we really wanted to get serious, maybe we could stack a couple of these up that are filled with enough ballast to support a short pole that could have a patch or yagi antenna on it?

..THE END… for now.



Charge regulatory KP2US has. Only 7A which most likely isn't enough?