Build an earth-sheltered log cabin

By Tok Thompson

Over a period of three summers, for a total of five months, I designed and built an earth-sheltered, passive-solar cabin. The structure is 12x30 feet, with the main room being 12x20 feet. Besides the main room, I have an ample-sized bathroom and a "mud room" entryway. The cabin is sunny, comfy, and easy to heat. The total cost? Under $1,500.

In essence, the design is a sod igloo, perfected over thousands of years by northern-dwelling indigenous peoples. The main function of the earth-sheltered design for them was the heat efficiency. Whatever heat seeps out of an above-ground house is whisked away by the wind, but in an earth-sheltered dwelling it is kept next to the house, dramatically slowing the heat loss process.

For someone to build a similar house for a similar price would not be that difficult. Of course, I scrounged for building materials as much as possible. I purchased, for a mere $80 at a moving sale, enough metal roofing to entirely surround the cabin, along with a large front window set for $20. The window was initially too big for the frame, to give them a year to cure and dry. Preparing the logs was actually the most strenuous part of the process. It took me a month and a half of constant work, and along the way I learned a few things.

First of all, there are several ways to make sure the logs are cured. One way is to kill them while still standing by peeling off the bark all the way around the tree and waiting until they dry out before cutting them down. Another way, which is the one I used, is to cut them down, take off all the bark and branches, and prop them up off the ground to dry. Still easier, however, is to use treated logs. I chose treated 2x12 lumber, two thick, creating the net effect of 4x12 wood beams. After carefully leveling these, I lay thick Visqueen (polyethylene) over them, to act as another moisture barrier between the house and the ground below, and then

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built a subfloor of 2x6 lumber and CDX plywood.

I ran a 2x6 header board lengthwise along the house and nailed the 2x6 support joists into it. If I had been building the cabin any wider, 2x6 lumber would not have sufficed. As it was, I still placed several supports in the middle of the expanse. A viable alternative here would be a concrete floor, which would have the extra advantage of acting like a solar battery to trap the sun’s heat during the day and radiate that heat back out at night. Personally, however, I prefer the look and feel of wood flooring.

**Putting up log walls**

When the subfloor was done, it was time for the logs. To move them to my building site, I used the bulldozer again, first pulling them with a chain, then using the blade to push them into the pit. One of the advantages of my underground design was that I didn’t have to lift any logs. Although it was occasionally awkward to position them, this step was remarkably easy for me. Before pushing a log into the pit, be sure to plan ahead how you will roll it into place! If it is balanced just right, it is truly amazing how a person can maneuver even a 2x40 foot log with one hand.

Joining the logs together is a little like playing the guitar. You can do all right without knowing much, or you can spend a lifetime devoted to your craft. While the more you know and do will always show in the results, an airtight fit is simply not as necessary with an earth-sheltered design. The gaps between the logs can be filled with concrete (mixing it with sawdust gives it better flexibility) or store-bought log chinking (though this can be a bit pricey, if economy is an issue). Since most of the outside walls are covered with metal sheeting and buried underground, small gaps do not mean there will be holes into the outside air. More care should be taken with the few logs that will not be covered and buried, but by the time you get to those you should be getting the hang of log work. I recommend laying insulation between the logs, especially if you are not doing any elaborate fitting techniques.

My fast-and-easy approach consisted of cutting slices with a chain saw where the notches were to be, and then knocking them out with a sledge. When the next log was to be fitted on top, I would position it for the least amount of gap space, and occasionally I’d use the chain saw to improve the fit by removing bumps and other obstructions. It is also important to alternate the large and small ends of the logs or you will end up with one side of a house much higher than the other.

**Roofing the cabin**

This design includes a shed-style roof, which provides for maximum sun exposure and is, incidentally, very easy to build. To provide the slant, simply stop alternating the log ends and use the thicker ends exclusively toward the front of the cabin. The front wall thus becomes higher than the back wall. I began to build the slant about halfway up the wall although, in retrospect, I realize I could have used a bit more slope. Variations in the level at which you stop alternating will also depend, of course, on the shape of your logs. The more tapered they are, the longer you may wait to stop alternating log ends.

One of my prime motivating factors in choosing the shed roof design was the fact that winter was quickly approaching. Since this design involved lumber, it was the most expensive part of the house. There are alternative methods that would be cheaper, but they would also require much more skill than construction with lumber and plywood does. First, I placed a center beam across two walls so that it traversed the middle of the cabin and gave support to the roof. Then pairs of 2x6 boards were nailed together, much as when laying the floor, using two-foot spacing boards along two walls, and plywood was nailed over the top of them.

I laid aluminum roofing on top of that, as well as over the portion of the log walls that would be buried. I put insulation between the 2x6s from underneath and stapled Visquene underneath that. This, combined with sod and snow on top, provides excellent insulation.

A rather large front overhang is a good idea for two reasons. It keeps moisture away from that part of the front wall that is above ground. And it also cuts out hot summer sun, when the sun angle is high, while not interfering with the low-angle winter sun. The winter after I finished the roof, Alaska had the heaviest snowfall in 50 years and many buildings in the area collapsed, but my cabin pulled through just fine and I never had to shovel the roof the entire time. After that, I felt more confident about my little igloo.

As I mentioned earlier, this roofing method was easy but a bit expensive. A cheaper alternative might be pole roofing, with the poles covered first by chicken wire and then by concrete, which could be water-sealed. I was looking at this method when the imminent snowfall forced my decision.

**The finishing touches**

The next summer I returned from a honeymoon trip up the Alcan highway, and my bride Katie valiantly joined the project, helping me put aluminum siding along the sides of the cabin and fill in the pit with gravel. After those two jobs were done, all that was left were the little things—moving in a Franklin stove, installing windows, doors, floorboards, and so on.

It’s been hard work, lots of fun, and in some ways a dream come true. Future plans include a full-service bathroom with hot and cold running water and a combination solar-
steam-powered electrical system. I have the plans now, and will write more later to let you know how they work out! Δ