One-Page Summaries

This collection is to help you quickly sort through the various technologies and experiments, so you can select those most relevant to your concerns.

In most cases, there will be additional information available in technosmith.com, while some entries will contain enough information to be helpful in their one-page format.

One-Page Contents

Domicile

Here is a way that you can build a structure from almost any sticks you can get find, and they don't even have to be exactly the same length.

There's only one rule to putting it together: The end of each stick rests upon the center of another stick (except for ends that rest on the ground). For additional security, tie or wire the ends in place.

This technology offers an opportunity for those who have no option but to live outside. If they have the blessing of at least owning a tent, two or three months of full sunshine and constant use is likely to seriously damage it. By building a canopy using this structure, and covering it with anything that could be found or recycled (plastic bags, cardboard, etc), It could provide shade to protect a tent from sunlight.

If scraps of water-resistant materials could be found it could be “shingled” to protect the area from rain, so it could become the emergency shelter in itself.

To demonstrate the minimal level of materials needed for a basic structure, I salvaged twigs from a branch that had fallen on a friend's shop.

If you can build any kind of structure from the materials used here, you can produce a shelter from almost anything almost everywhere. As far as I know, there would be no theoretical limit to the size that could be built.

Here a more complex form of this technology is used to cover a cylinder of wire and cement set into the ground.

Wired Shelter

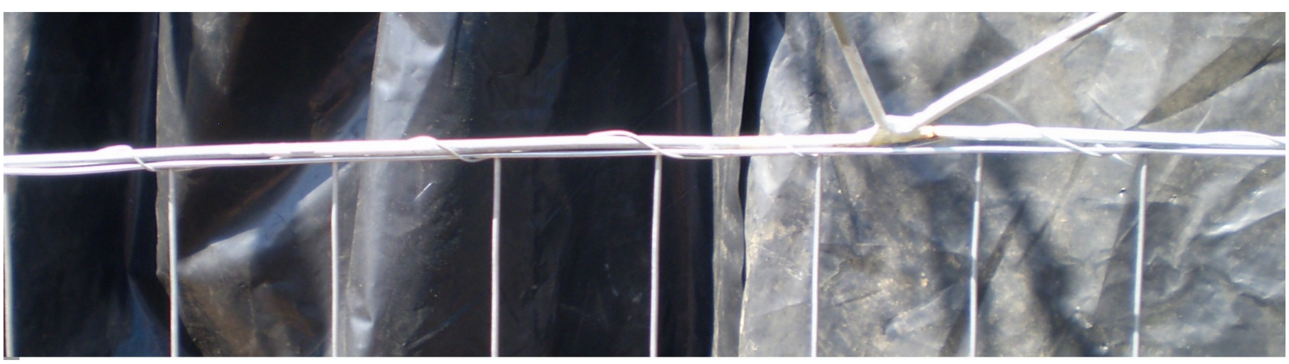
This was an effort to develop the most stable and economical shelter I could imagine. The result is a wire structure, which in conjunction with a roll of #18 wire and scraps from almost any dumpster, provides 44 square feet of protected living space.

With a center height of about 6'6", most of us can move around comfortably (if you don't feel like walking farther than it's 7-1/2 foot diameter).

The most significant benefits are that it can be built for less than $50 worth of material and only weighs a total of 24 pounds (the top only weighs 8 pounds).

The top is a dome fabricated from pieces of #9 gauge steel wire welded together. This wire is commonly used to stiffen the bottoms of chain link fences and is widely available at home improvements stores. The welding may be achieved with a standard oxyacetylene torch using a 00 tip, but I recommend using craft-scale torch with the much smaller tips available (I've used both).

The wall is 25' of 5'-high wire fencing – most commonly available in 50' rolls. This is simply wired to the top dome frame. With the dome diameter being 7-1/2', twenty five feet of wire allows for enough overlap to provide a visual screen for the door.



16' Bolt-Together Dome

R. Buckminster Fuller was a visionary born near the end of the nineteenth century. As a man concerned about the world's shortages, he invented the geodesic dome as a means of enclosing large volumes with a minimum of material.

The dome frame is made from 3/4" thin-wall conduit. It's 16' 8-1/2" in diameter, about 215 sq.ft. in area, and weighs about 130 lbs. Disassembled, it packs into a bundle of struts about 11" in diameter by a little over 5' long.

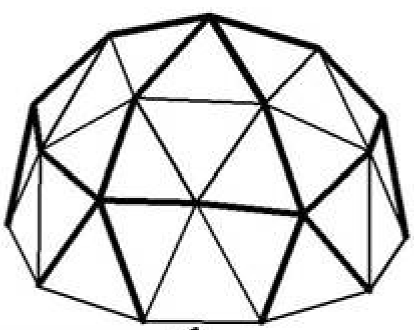
Twenty-six 1/4" X 1-1/2" bolts plus nuts are needed to bolt it together.
It requires two different strut lengths so I calculated where to cut a 10' piece of conduit so you would get a long one and a short one out of each stick (that is how it came out to 16' 8-1/2" diameter). You need five more long ones than short ones, so for the 65 struts required, you'll need to buy 35 10' sticks.

Cut each one 63-9/16" from one end, and flatten about 2" on each end of the two resulting pieces. MAKE SURE that the flattened ends are in line with each other, rather than twisted into different planes.

DO NOT use a driveway, concrete floor, or concrete anything else as an anvil. The repeated shock of even this hammer will begin to produce cracks far sooner than you might imagine.

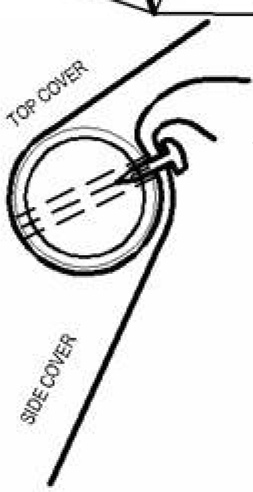
Drill a 5/32" hole about ½ inch in from each end.

Bend the ends about 15 degrees in the same direction, so they will be tangent to the same 16' sphere.



In assembling the dome, the dark lines represent the short struts, and the lighter ones the long struts.

This structure has quite a bit of volume for its weight, so under windy conditions you might prefer tying it down to terrorizing the neighborhood with an exceptionally large tumbleweed.



Coverings for this dome have included various forms of plastic, a parachute, wood, and even cement. Fabrics or plastic sheeting can be attached by impaling them on sheet metal screws in a pattern that overlaps to shed water.

Little Mud Stove

I found a 7”X10” scrap of 1/16” thick steel (which is about 23 square inches smaller than a standard piece of printer paper), and challenged myself with the task of building a stove out of it. The flue would be a couple 5' sections of 3” sheet metal pipe. A small scrap of steel was the only tool employed.

I began by tramping on the moist earth beneath me, and adding a little to form a slight rise a couple inches high.   I then dug a couple of 3” holes about a foot deep as shown below. Their centers are about 8” apart, but none of the dimensions are critical.

The hole on the right goes down about 3” and then widens out to about 6 inches. This is where the fuel will be burned. At the bottom, I tunneled to the other hole.

I dug out a 2-1/2 inch deep box, 6”X9”, so I'd leave 1/2” overlap all around the 7”X10” scrap of metal. The nearest end was centered over the hole on the left. By digging downward at the other end I was able to make a channel to a third 3” hole, to which I connected the 3” flue pipe

Here's how this thing operates, and why it works: About 40%of the energy in wood is in the form of smoke. In order to burn the smoke you need a hot fire and plenty of air – but who wants to sit there and keep blowing on it? So, I used the 10 feet of flue pipe to create the draft to pull the air through the fire.

It then blasts directly against the bottom of the steel plate, travels along the underside of the plate, out the bottom of the far end of the box, and finally up the flue.

To get the draft started up the flue, so you can either place a small amount of flame in the hole directly under the flue, or singe your eyebrows by blowing into the fire hole.

The proof is in the testing, so I noted the time it took to bring one liter of water to boil on our modern gas stove (ten minutes), and compared it with this stove (sixteen minutes).

The disadvantage in this case is that whereas the flame of the gas stove played directly on the bottom of the container, heat must now be absorbed by the steel plate, and transfered to the container through the contact of two hard surfaces. A further complication was that the plate bowed upwards when subjected to the heat, so the contact was between a slightly rounded surface against a flat one. I recommend using a thicker piece of steel.

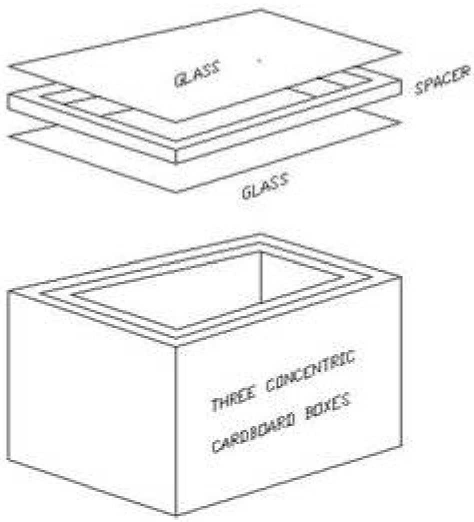
Solar Applications

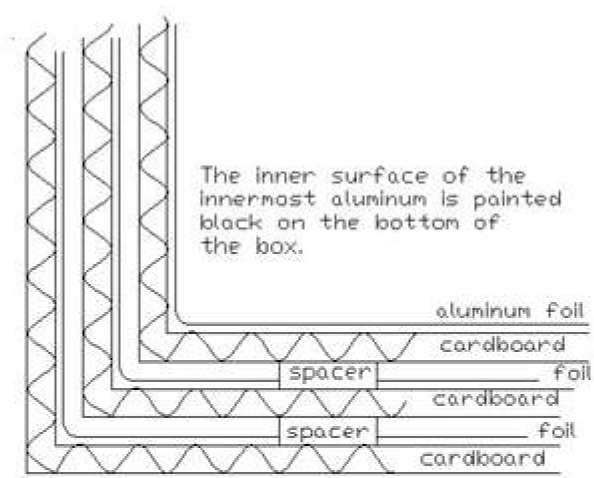
A flat black surface directly facing the sun can absorb up to about 300 BTU per hour for every square foot (One BTU will heat one pound of water one degree Fahrenheit). One gallon of water weighs 8.345 lbs. This square foot would heat one gallon of water by 300 BTU/8.345 lbs = **36 deg. F**. per hour.

Such is the potential available, but there is a lot more to the story that will not allow you to capture all of it. Even so, you can still capture better than 50% of it for the equivalent of 5 hours/day.

Sun in a cardboard box

This contraption consists of three layers of foil-lined cardboard, with a double layer of glass over it. Don't underestimate the value of the foil. Although totally lacking in insulating value, shiny aluminum keeps in better than 90% of all infrared radiation. Since the amount of infrared radiation is proportional to the 4th power of its absolute temperature, the importance of this aluminum foil is significant.





I initially used it to heat water in a couple of black-painted gallon milk jugs for bathing. They were resting on a shallow sheet-metal pan also painted black. With this cheap simple arrangement, water would still be too hot to use directly for some time after sunset.

When I returned to a more "civilized" bathing pattern, I began using it as a solar cooker, and found nothing I couldn't "crock-pot" during the course of a day. These challenges included beans, and even baked potatoes. For proper cooking, the food needs to be in a dark container. The cheap black or dark blue enameled cookware common to supermarkets and second-world countries is ideal.

It is important to either be prop it at an angle to face the sun, or set up with some kind of a reflector.

Solar electric systems of about 50 peak watts cost less than $250, plus the cost of a heavy-duty battery. They can provide tremendous advantage for lighting, recharging cell phones and power tools, or running laptops.

By connecting a 2.5kw inverter to a solar-charged battery, I have even been able to run a lightweight (117VAC) welder for fifteen minutes or so.

Once a basic solar-electric system is in place, you can usually upgrade the capacity of the various components as resources become available.

Lighting

The amount of lighting needed, like many commodities, is more dependent upon how it is used than on how much you have.

Light intensity diminishes with square of the distance from the source. This means that you would find the same amount of light on a page one foot away from a 1 watt bulb, as you would ten feet away from a 100 watt bulb.

Another way to enhance the utility of light is by reflecting it in the direction you need it. I have used small automotive fixtures with built-in reflectors for low-power reading lamps in camping situations.

Even within the conventional lifestyle, I have sometimes backed up lighting with shiny aluminum foil, when I could do it in a way that it was not normally visible.

Still another way to optimize your lighting is to use levels that are appropriate for the activity at hand. For instance, normal movements around the house and relaxed conversation are comfortably managed at greatly reduced light levels, and dinner by candle-light has rarely been a direct cause of stress. In fact, I find a lower light level environment more relaxing. Save the kilowatts for tedious hand-work and reading

If you put the light where you need it, and in the amounts that are appropriate, you can substantially lighten your bill.

In order to keep electrical hazards to minimum, I recommend keeping electrical circuits to a low voltage level. A 12 volt system makes the significant variety of automotive lighting sources available.

Among electrical lighting options incandescent bulbs are the least efficient. Fluorescent bulbs and LED's are several times as efficient as incandescent bulbs, and last several times as long.

Flame is the ancient standard and comes in many forms. The simple technique described below can get you started.

Oil Lamp

Have you ever been in a situation where you wanted light and there was simply none available? This lamp is so simple and versatile that it can provide you with basic lighting under almost any circumstance.

The only materials required are an aluminum beverage can and a tuft of fibrous material, such as toilet paper or cotton cloth. I even used a fibrous mineral insulation on one occasion.

The lamp may be fueled by animal fat, vegetable oil, or mineral-based greases and oils. I have had some problems with additives in motor oil clogging the wick and self-extinguishing after short periods, but even that doesn't make them entirely useless.

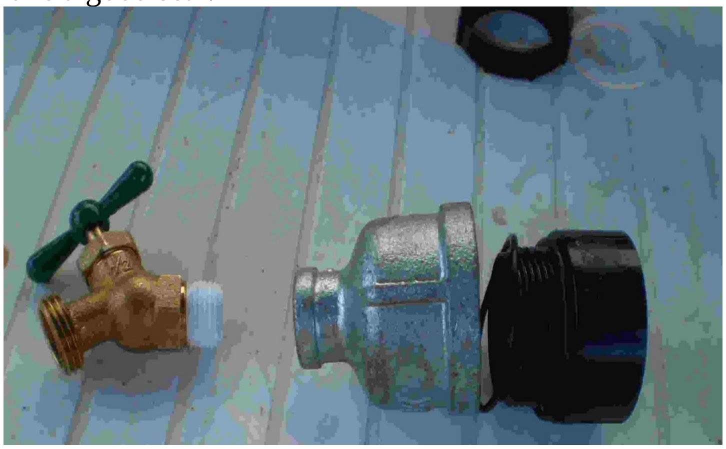
Begin by cutting or tearing the can in half, and turning it over. Cut or tear a circle about 2 inches across from the unused portion of the can and poke a hole in it that is 1/4" to 3/8" in diameter. Wad up your fibrous material into about a 1" ball and pull about a 1/4" portion through the hole.

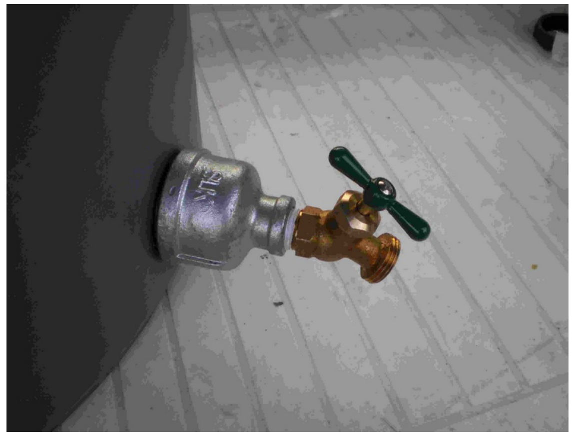
To use the lamp, fill the depression in the inverted can with your oil or grease and work some of the fuel into both sides of the wick. Lay the wick assembly on the fuel and light.

If the fuel is a solid grease or fat of some kind, the heat of the flame will soon cause it to melt and flow, like an oil.

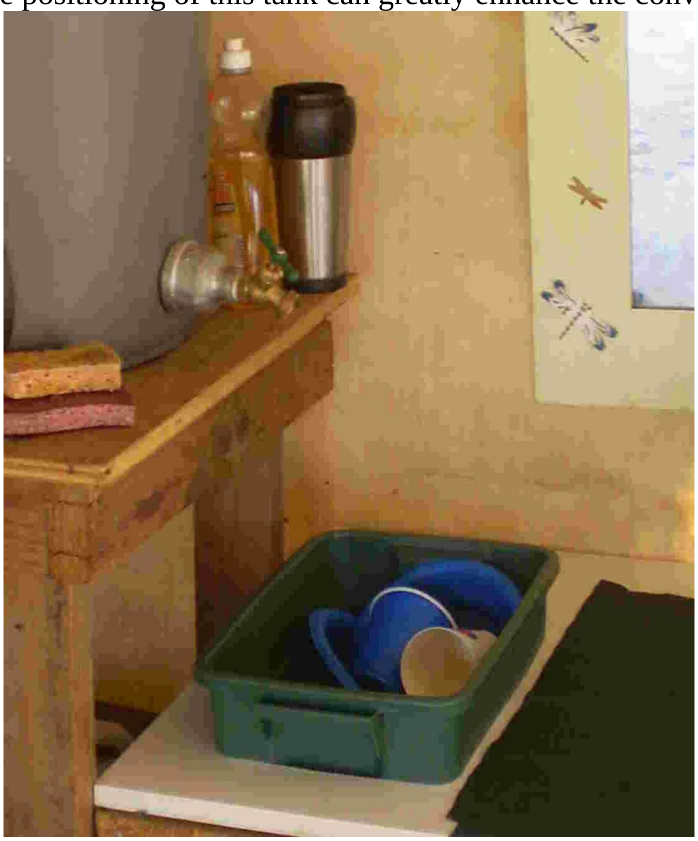
30-Gallon Tank

A convenient tank can be made by installing a faucet into the bottom of a 30-gallon trash can. I used a plastic can, although I'm sure a metal one could be made to work. I am sure there are many ways to do this, but this photo shows how I did it with common off-the shelf plumbing hardware. The “O” rings are not real obvious in this photo, but they were essential immediately inside and outside the plastic to make a good seal.





By using this tank, smaller containers can be used to haul water to replenish a common supply. Individual or multiple users can then keep this supply replenished as they run their respective errands. The positioning of this tank can greatly enhance the convenience of an emergency camp.



As resources improve and acquisition of water becomes easier, several such tanks could be developed for different tasks – such as bathing or gardening.

Sanitation

While doing construction in the Colorado Rockies I was camping next to a stream. I would dig a hole as deep as my arm would reach, kick in a little dirt after each use, and finally fill in the last six inches. Each hole served as a latrine for at least two or three weeks. There were no smells, no insects, and the posture itself was more natural to the human body than that of our porcelain-padded cultures.

A simple auger that could put a 6” diameter hole down 5' or more would be a big help. Based upon personal experience with this type of solution, I would expect a hole of such dimensions to serve an individual for a couple of months.

This auger was welded from a piece of 6” pipe with a few ugly attachments, plus a 5' extension with a handle.

Bath Pan

I did an experiment for a couple of weeks in which I bathed using two gallons of solar heated water diluted to a usable temperature with cold water. I was very surprised to find that this was more than enough for a good bath and rinse. This works very well in a simple plastic trough designed for mixing cement, available from your local building-supply store.

This was applied later inside a 16’ dome while camping. It was very pleasant to enjoy hot baths from solar heated water in the late afternoons after a day of tourism and play. A limited amount of laundry could be done in this same unit.

Mobile Homeless

For the upwardly mobile homeless, we have an improvement over the shopping cart. Consider a frame thirty inches wide X 7 feet long X 16 inches deep. It rides on pneumatic wheelbarrow wheels with a total load capacity of about eight hundred pounds.

The width and length are adequate for off-the ground sleeping, and combined with the depth, is has a capacity of a little over twenty cubic feet. The low height and removable handle (same height as a shopping cart when installed) makes camping out-of sight fairly easy. The frame was welded up from 1-1/2 inch square tubing 1/16" thick, and weighs just fifty pounds.

The heads were cut off of 5/8" bolts and welded to a piece of angle iron to provide axle support.

2X4 studs bolted to the bottom allow the axle assembly to be mounted in the center for a balanced trailer, or positioned farther back if a steering caster is to be added to the front.

The total cost for frame, enclosure, and wheel assemblies was under $150.00.

Water Table

The objective is to save water by creating a plastic-lined bowel under a garden space.

This experiment involved digging out a garden bed with a vee-shaped bottom.

I laid some perforated drain pipe, connected a riser for access from the surface level, and bedded it with gravel. The riser will allow the monitoring and control of this artificial water table.

After back filling the bed, fifteen gallons of water were poured down the riser. A water depth of about a foot was measured by a wooden dipstick.

The next morning gave me my first lesson (besides the aches in my seventy-something body from all that work). The water was all gone except for about an inch visible down the riser. Clearly it had been wicked up by the soil.

A raised portion was developed for some squash plants – that promptly expressed their approval with abundant growth.

In another part of the yard I topped a lined trench with a row of cinder blocks and planted sunflowers in alternate holes. The cinder blocks had been sealed to prevent water from soaking up into them and evaporating through them.

Community Center

A number of years ago I spent a few evenings enjoying the campfire and hospitality of a small nomadic group in an Arizona desert. Meals were prepared on a dilapidated picnic table behind an abandoned building. After an hour or three of stories, laughter, and occasional serious lines from their patriarchal leader, people began to leave the fire for their tents, vehicles, etc., and I would walk back to my own camp a mile away.

In this, I was experiencing community in its simplest and most economical form. The shared resources of “kitchen,” and “living room-dining room” minimized the redundancy of precious commodities. Similarly, many of us have experienced conference grounds with common facilities.

For those who fantasize creating an off-grid community, the development of a physical community-scale structure would be a practical place to begin.

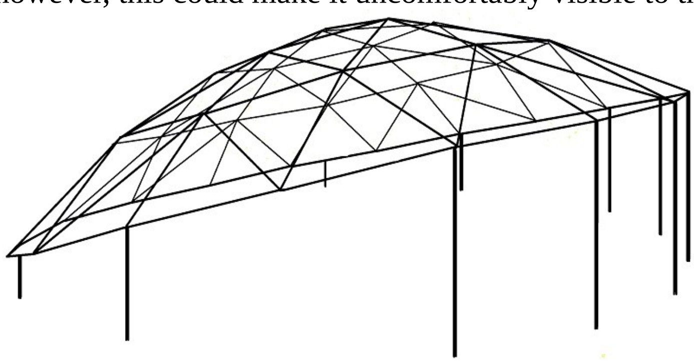
The minimum appointments of this facility would include a place to cook and enough room to dine and hang out in cold or wet weather. With basic space heating provided, separate sleeping facilities could forgo the need of individual heaters, if they were weather-proof and had adequate blankets.

Evening lighting in this area would facilitate study and other evening activities, and further relieve burden and expense from individual shelters. There are a couple of structures within my own experience that would be suitable for such community-scale shelters.

This photo shows the interior of a parabolic dome 20' in diameter by 10' tall. As of this writing, a 28' diameter version of this serves as the kitchen, etc. for a small camp.

Incidental to the structure itself, is an efficient cook stove built right into the floor. This feature may or not be practical for a community situation.

Being both parabolic and a bolt-together structure, it could be expanded at a later time, and the resulting increase in height would allow an upper floor to be added. In a downtown environment however, this could make it uncomfortably visible to the surrounding neighborhood.



Alternatively, a low-profile parabolic structure such as illustrated here may be more practical. Head room is optimized by tilting it slightly, and the low vertical aspect would minimize the visual impact. Here again, another course of triangles could be added to expand the perimeter at a later time if desired.

In this case material must be added to enclose the periphery during the winter. This material could be removed during the summer to allow breezes to control the heat.

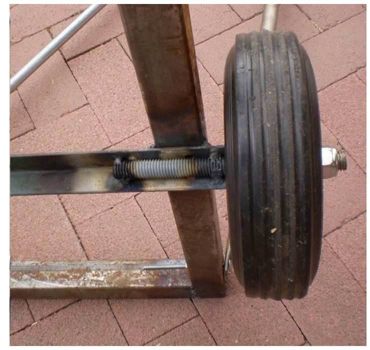
Summer heat could be further mitigated by using an external stove and/or solar appliances for cooking and heating water.

In addition to this building, smaller community structures could serve the group for things like sanitation and bathing.

Recycling Cart

Shopping carts are the most common limousine of the homeless recycler. The problem is that they belong to someone else, who is quite justified in begrudging the loan.





This cart has a welded frame of square 1-1/2 X .062 steel. The rear axle is a piece of angle iron with pieces of 5/8" all-thread welded to the ends for mounting the wheels. These wheels and the castor on the front have a combined load capacity of 750 lbs.

The handle and its framework are made from pieces of 3/4" and 1/2" conduit, with their ends flattened and drilled so they could be bolted to the frame and to each other.



One of the most important things I've ever done, is to fail. Wisdom is to schedule your failures so you gain your lessons while you can still afford them. So I put the cart to a fairly extreme test. I call this type of wisdom "an experiment."

It took a bit to get this load rolling, but the momentum it had before hitting the ramp to go up onto the lawn stubbed its toe against the ramp. Greater stability was achieved by using two castors bolted directly to the frame.

A wire cage was then added to contain cargo.


The Cozy

How small could you make a comfortable dwelling? If you are willing to share external sanitation facilities in a separate shelter, you might consider using some of the ideas shown here.

This structure is 7-1/2 feet in diameter, has a brick-paved floor, contains a space heating/cook stove, and is set a couple of feet into the ground. The stove and above-ground features utilize technologies shown elsewhere in this collection.

The perimeter retaining wall is two layers of galvanized steel mesh plastered with premixed mortar cement – just add water.

The view below shows the built-in floor stove on the right, above which you can barely see the wire structure of the surrounding wall.

This wall structure is simply wire field fence, which you may obtain in 5' widths.

For a convex structure on the top, you can use a welded wire dome, or a more complex rendition of the any-stick dome technology.

The covering for this hovel was a slightly abused plastic above-ground pool.

Obviously my architect invested little in trying to make this prototype beautiful.