THE EASYDOME SYSTEM

DIY Biodome Instruction For the Rest of Us

How to Design, Build and Assemble Your Own Geodesic Greenhouse Dome, So You Too Can Grow Incredible Food Year Round For Your Family, Friends and to Sell.

YES, It's That Easy To Create a Massive Geodesic Biodome Greenhouse That Produces Food Year-Round Even in the Middle of Winter

WHY BUILD A BIODOME GREENHOUSE ANYWAY?

First of all why would anyone want to actually build a Geodesic Greenhouse Biodome?

As somebody famous once said, “Let me count the reasons!” and throw in a few benefits as well!

Things are getting very "interesting" on our planet as you may have noticed. Food shortages are becoming more common, deserts are expanding, floods, super storms and droughts are becoming more common and global food stockpiles (wheat, rice etc.) are at an all time low. Thinking about that, I have to agree with whoever said, “If you aren't concerned, you aren't paying attention”.

But what can one person do? Well, I asked that question myself (after our son joined my wife Amy and I), so we began researching, reading and talking to others who are concerned too. It soon became very clear that if you do not prepare your family for the coming changes, if you cannot provide for your family with your own renewable food supply, then you're in for great hardship in the coming years.

In my opinion the time has come when everyone who sees the “writing on the wall” must take action and learn how to return to the land, join with like minded folk and regain lost skills. However... many of us can't do that for whatever reason. But you must take action just the same. That's where people say But, what can I do right now? Many things of course, but building your own geodesic biodome greenhouse and growing your own chemical free food is a great start!

Really having your own back yard food factory is like owning your own garden of Eden (minus the snakes!)… The way I see it, you're not just building a biodome greenhouse, you're building and investing into a whole new life-style. Imagine waking up in the morning, knowing that today, you do not need to worry, or be fearful about having enough fresh, wholesome, organic food. And lets face it after water and air, food IS survival. Once you build and set up your dome the rest is taken care of by nature, so you can do whatever you want to do with your time. If you want to work today, that's up to you. If you want to paint a picture or go for a walk, you can do it. If you want to simply sit and do nothing, you can do this too. Your biodome greenhouse provides everything for you. Water, Food, Shelter, Comfort, Warmth, and it even Spiritually nourishes your soul. This is the direction you’re moving in by building a biodome.

Take a moment to close your eyes and imagine living on your own terms, having amazing food, and being in control of your destiny. When you think about how

most people live their lives today... 99.9% of their time and energy is spent on survival, running to stay still or even falling behind and just scraping by. How much of your energy, your life-force do you put in, just to have basic needs met? If you're like most people, that's an insanely large amount of your personal energy. How much does it pay back? This life-style is non-sustainable, and non-nourishing because you have to be constantly running, constantly "just squeaking by" just so you can make enough "energy" (money) to pay for this life-style... All this, JUST so you can survive! And survive for WHAT? For the sake of MORE survival?

If like me, you feel tired in your soul of this way of life, and you have an inkling inside, a knowing, that "there must be a better way to live", then perhaps together we can take the first steps towards a truly free humanity and a radically different way of life, in harmony with nature, full of love, peace, and creativity.

THE CHALLENGE OF CHANGE

The reality I described in the first section, where you wake up and your home is taking care of you, is not only a possibility, it is real. People just like you have done it and are already living it. Anna Edey, author of "Solviva - How to Grow $500,000 on One Acre and Peace on Earth" was one of my earliest inspirations, she proved that you could grow tons incredible food year round, even in below freezing conditions.

Architect Michael Reynolds is another great example, who builds sustainable communities and monolithic dome homes out of recycled material in Arizona which they call "Earth Ships" (Watch this incredibly inspiring documentary about Michael, called the "Garbage Warrior" on YouTube HERE)

The only reason why life continues to be the way it has so far and why this life-style prevails, is because it has become habitual, “normal”, and it has enormous momentum, and as Newton said “an object in motion tends to stay in motion”, but this way of life is quickly crumbling all around us, both because of economic reasons, but also because more and more people are waking up to the fact that it simply doesn't work, and isn't sustainable.

In the humorous words of Dmitry Orlov, a foremost authority on the collapse of North American society: “We have lived in a time where most of us have been pre-occupied working at jobs selling stuff made in China. When our Chinese stuff broke we outsourced the customer support to India. And we paid for it all by flipping houses, seemingly worth millions, but really made of worthless ticky-tacky and plastic”.

A different way of life is possible, but as wonderful and motivating of a vision as it is, and as exciting as the prospect of “your very own Eden” is, it a daunting and great challenge, you will have to put some effort into this. There is work required in creating this new life-style, and there is definitely work required in building your bio-dome and setting up your Easydome System. However, the work you’re about to do will be one of the most rewarding, fun and exciting times of your life. For some people it’s even a life- changing spiritual experience. Because you’ll be working on something that is truly nourishing your soul, and creating a real future for your family.

I can tell you when that final strut of the dome goes in the top, and you bolt it in… and suddenly the frame you labored over so long is TIGHT and STRONG... and you see the fruit of your labor… knowing what it’s all for… I can’t explain the feeling you’ll have.... You just have to do it! So Good luck! And remember to wear eye-protection when using power tools!

FEATURES AND BENEFITS OF YOUR EASYDOME GREENHOUSE

1. **The “WOW” Factor**

The geodesic dome, popularized by Scientist Buckminster Fuller in the Mid 20th century, is the strongest structure known to mankind. You can literally bolt together a few 2x4s from Home Depot into a geodesic dome, and if you do it right, your structure will be capable of withstanding Earthquakes, Tornadoes, and Hurricane force winds. Compare that with a plywood square home built for $100,000 and watch it blow away or crumble in the next natural disaster (which there seems to be a lot more of lately with the climate and planetary changes). When you combine that with all the other factors below, you'll get even more excited...

2. **They're cheap to construct!**

DIY biodomes are extremely inexpensive to construct. Whether you're building a simple green-house dome, or a living dome, it is astonishing how cheap they are. In fact they give the most open space of any type of building.

3. **The Simplicity**

Geodesic domes are straight forward. To get started all you need is a saw, a good drill, some 2x4s, bolts and screws and you’re ready to get started. In the Easydome System we explain the revolutionary new hub system we came up with. It's simple, flexible, strong and one of the least expensive ways to put together a dome on the $7.00 per hub!

4. **The Portability Factor**

If all of a sudden you have to move, you can disassemble your dome and move. It doesn’t have to be a permanent structure.

5. **Easy to Heat**

Geodesic domes are the most efficient spaces to heat. Because the space inside is essentially a sphere, the air moves fluidly all around. The warm air rises in the center of the dome, either initiated through solar heating or a heat source, and flows down the sides to be heated again.

Heating and Insulation are the greatest topics of debate these days with modern housing and also the largest cost with housing design. It can be the deciding factor whether a design gets built or scrapped. Most spaces are grossly inefficient in heating due to the factor that everything is boxes and squares. Air doesn't like to move in boxes or squares, nature doesn't do that. It likes circles, and it likes flow. This is why it is such an ideal structure for growing plants and using it as a greenhouse biodome!

6. **They Look Great!**

The geodesic dome is just amazing to be in for sleeping, growing food, socializing or meditating. There's something about being inside a geodesic dome that opens your mind, your heart, and allows you to breathe a sigh of relief.

7. **It Nurtures The Body & Soul**

There is divine geometry in nature, it's why nature feels so right, its why we're all drawn to being outdoors, the ocean, the forest. Our human spirit loves resonance, and there is something about being inside a geodesic dome space that profoundly resonates with your soul. I cannot convince you of this until you step into one, you'll see for yourself… and when you build it with your own hands, wow, what a feeling! Just take a look at this picture below of the dome I built while developing the Easydome system, there is just something amazing about the dome shape and the way it interacts with the light.

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EASYDOME CONSTRUCTION

Congratulations on taking action! You have taken a huge step toward assuring that you and your family will have ongoing food security no matter what happens to the rest of the world. Before we get started, **be advised this is construction**. If you aren't up for the challenge now is the time to get a refund. The last thing I want is for you to buy the Easydome System and not use it! That being said the construction described here is simple and straightforward and we have addressed most if not all of the problems you may encounter.

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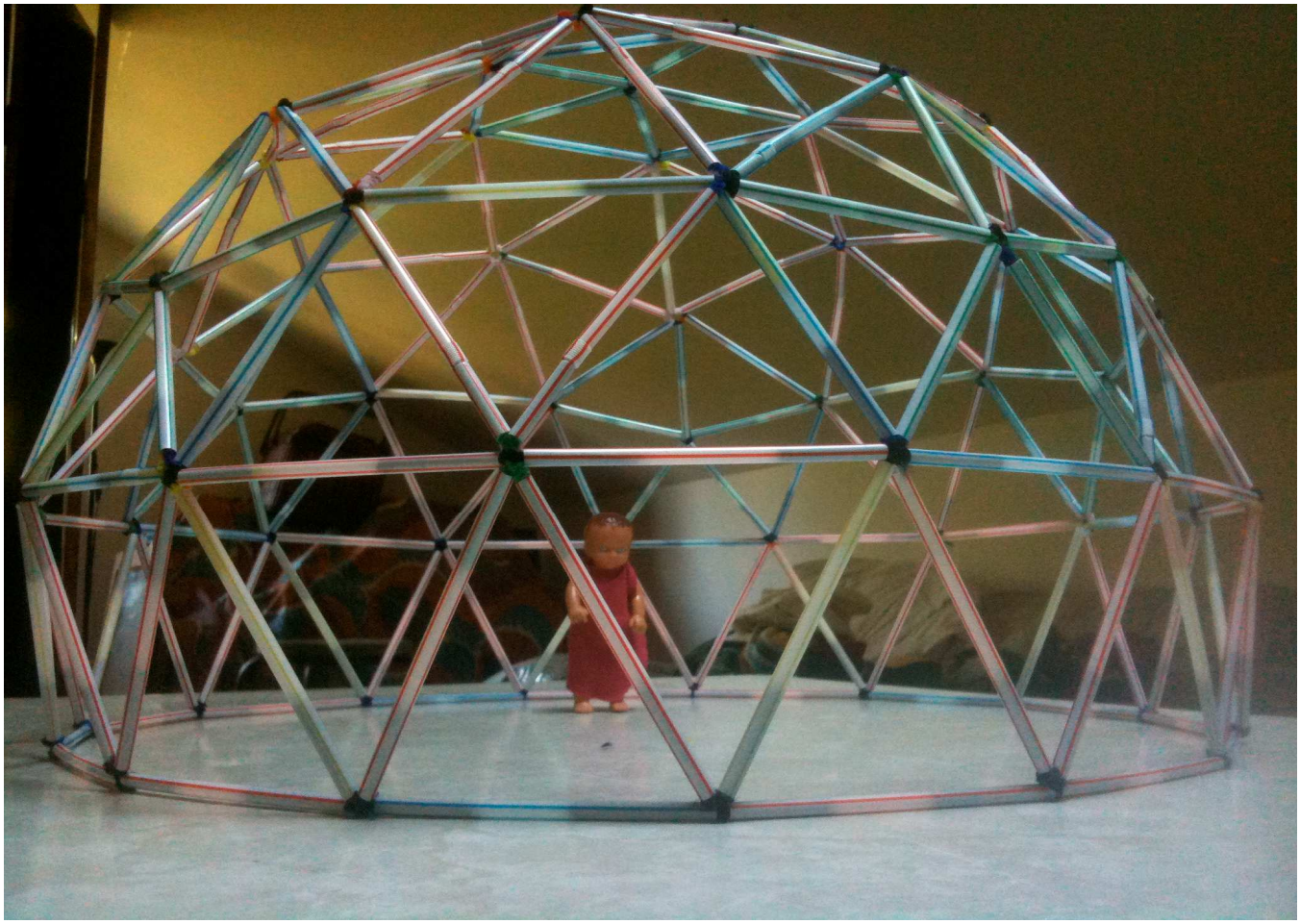

18” Kruschke 3V 5/9 Drinking Straw Pipe Cleaner Hub Easydome Model

Of course you will need to know how to use basic hand and power tools to complete your dome. If you don't feel comfortable with this type of work you can hire someone to help you build your dome for you or better yet do a work trade with someone who has the tools and experience to do the building.

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Even if you have never built anything in your life the Easydome system is simple and forgiving so you CAN build it yourself, of course if you are a beginner it will take longer. But *you will never forget the feeling of achievement* when you look at your completed dome! Feelings like that are ones that last forever! BUT... before you buy any 2x4's, clear any ground or any other such large scale tasks please, first make a model!

At least a table top one to get comfortable and make sure you know how the calculator works! I did my 18" dome model out of color-coded drinking straws and pipe cleaners for the hubs. You will need A LOT of pipe cleaners (cut them in 3rds)! Then when you have your tabletop Easydome complete and the finished project clearly in mind... run your project by the building authorities or build where your neighbors and any official types won't see you building. But for peace of mind, especially in more populated areas check with the county about the size you can build without a permit (usually based on square footage). Even if you have to build two domes the advantage of not having to deal with the bureaucrats is worth the extra time and effort!

DISCLAIMER AND LIABILITY RELEASE (READ IT. ITS SHORT)

WARNING! Construction can be hazardous! Use proper safety equipment including personal protective equipment, fall protection and do not work alone, secure ladders, use guards on all saws, read instructions and follow manufactures recommendations for safe tool operation etc. The information contained in this eBook is for EDUCATIONAL PURPOSES ONLY. Not to be used for actual construction. Consult a Red Seal carpenter, licensed contractor or architect before undertaking any construction project. The Author,

www.geodesicdome.org assumes no responsibility for improper use or abuse of information contained in this eBook. By reading further you assume full responsibility for your actions and accept any and all hazards of any construction you undertake or participate in.

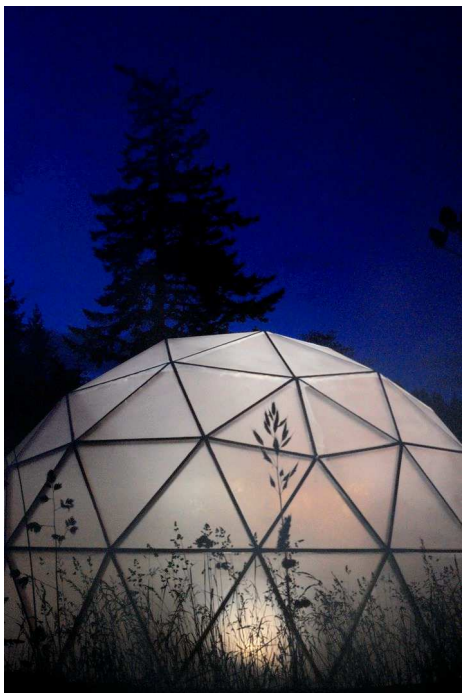
WARNING 2 For domes larger than 25ft we recommend heavier lumber and thicker metal for the tabs. You WILL require these tabs to be made for you at a machine shop adding to the cost but saving you a ton of time.

WARNING 3 If you are use the online calculator be aware that it may output a foundation size (perimeter) that is WRONG (at least last time I checked) because it is based on the spherical diameter of the dome rather than the actual footprint. (See planning your dome section for how to overcome this or grab a membership to the Eden Biodome Revolution Site, to view the complete build videos, vent opener install, heater upgrade and use the free calculator)

WARNING 4 Power tools are dangerous! If you are not trained and equipped with all required safety equipment and personal protective gear DO NOT TRY THIS AT HOME! Find someone who is qualified to teach you or do a trade for the work you need done.

LETS GET STARTED!

If you are still reading then you have accepted 100% liability for your actions and now is the time to decide on size for your dome! In this manual and all the pictures, we will be discussing a 24ft 3v Kruschke Biodome with a 5/9 truncation. If that sounds like Greek, don't worry! It will all become clear as you follow along with the manual. The math for this dome was originally devised by David Kruschke in cooperation with Buckminster Fuller. The main advantage is



that it gives us a higher dome with straighter walls at the bottom while still keeping a flat base. Use the calculator generously provided by Domerama to help design your dome.

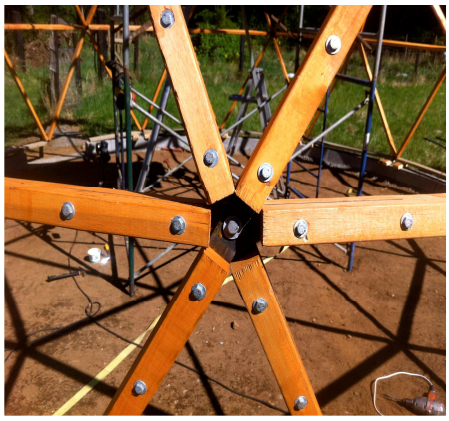
www.domerama.com/ calculators/ 3v-geodesic-dome-calculator/ 3v-flat-base-815-kruschke-calculator

For your first dome we recommend starting small and getting a "feel" for the techniques before doing a large dome. Most people do a 12ft Easydome first to get a sense of how it all goes together because then you can basically just half all the numbers I use in this book.

Alternatively you can decide on a size, use the online calculator then pre-cut the base struts after using the calculator, then connect the struts together and lay them in a circle, mark the outside of the circle with spray paint or lime then use that shape to layout your foundation (if you are doing a cement block foundation) as I describe in this book.

If you are building a dome that will sit directly on the ground (on gravel, rock or sand) then you can disregard the previous step as it only applies to those wishing to build a fixed foundation with stem wall. You can also ignore all the stem wall, foundation, and drainage (depending on your ground level) sections as well.

However if you are planning to place your dome directly on the ground you MUST fasten it down! Domes can withstand more wind than a standard shed, or house but must be firmly anchored to the ground in order to do so. I suggest digging some "post holes" on the inside and outside of your dome, putting some rebar bent in an upside down U shape with the legs of the rebar down in the holes then fill with cement. Do this at least every 5ft with the “U” over the base struts holding them down and you dome should stay put.



I have done my best to go with readily available "off the shelf" components to make the build simpler and faster with NO complicated cutting. The connector system we will use will be fabricated from 1/8" x 1.5" hot rolled, steel flat bar, drilled and bolted into the ends of our 2x4 struts. This allows you to have all angles easily adjustable, you can make 4, 5 and 6 way hubs and also eliminates complicated compound miter cuts while keeping the advantages of wood.

PICKING A SITE FOR YOUR EASYDOME

Pick a site exposed to the south with minimal shade from buildings or trees (especially in December also consider using a solar tracker like Sun Seeker Lite for iPhone) to establish your solar gain. Then make sure your chosen site is reasonably level; not more than 2-3 degree slope (use a long level, laser or transit to establish slope).

A Word About Tools

When you see the list of tools and materials in Appendix 1, it can be easy to get overwhelmed if you're a beginner! Remember, this actually isn't a lot of stuff, and you do not need it all at once! Most DIY people will have most if not all the tools already. The most important part here is to just get started! So what I am going to do is put the complete tool and material list at the end of the book for you to refer to, but right now for the site prep you need:

Number one useful tool for construction: **A Pickup Truck! Or a utility trailer.** You can have things dropped off by your local building supply store but it becomes expensive and you will inevitably need to go and pick up things yourself.

PREPARING THE SITE

Site Prep Tools and Materials Required

- 4ft level or self levelling laser level - to show level
- shovel (or mini excavator) ;) - to clear sod and level
- garden rake or landscaping rake – to level your site
- wheelbarrow – to move sod
- string - as long as the radius of your dome (6ft for a 12ft dome)
- big spike or pin - to put in the middle and tie your string to
- small bag of lime or spray paint – to mark things
- a place to put your sod (pile it upside down cover with a tarp and it will soon become awesome soil)

If proposed spot is on a bit of a slope, some excavation will be required to flatten it out. A mini excavator is a great tool for this. Well worth the cost of having someone come in and prepare your site. That being said you can remove the sod, and level the site using hand tools, it just takes longer. Stockpile the extra soil, if you are going to do soil based growing beds upon completion.

Keeping the Bad Guys Out

If you have digging animals in your area then a layer of fine mesh galvanized rodent wire goes down before the foundation, to help keep any unsavory characters from tunneling up or be prepared pour an adobe, cement or papercrete slab inside your foundation.

Drainage (if required)

Tools and Materials Needed

- shovel or mini-excavator – to dig drainage ditching
- Big-O perforated flexible drain pipe – to take water away
- landscaping cloth – to wrap around the Big-O and prevent fine soil from coming in and clogging it up
- 4-6' level or self levelling laser level – to make sure the drain slopes properly
- 1 yard clean gravel – to go around the Big-O

If you are building on any kind of a slope make sure there is a shallow ditch or swale above your site to catch and divert any surface water around and away from your dome. Also if you have a high water table under your building site you will need to put in some perimeter drainage to keep the floor from becoming saturated.

If you need perimeter drainage the technique is: dig a ditch that extends below the bottom of your expected foundation install Big-O drain pipe wrapped in landscaping cloth, make sure it all slopes to a place where the water can escape (down hill, ditch, etc.) cover Big-O with clean gravel and another layer of landscaping cloth and then build foundation and backfill. You can even insulate the outside of your foundation if it gets very cold in your area. There are various other ways to achieve good drainage with the simplest being to raise up the foundation and keep it out of any water or build in a location that has good drainage already where water won't be an issue.

Choose a Foundation Material

Domes can be built on anything from a poured concrete foundation to a flattened patch of dirt, we were lucky because our site was very sandy and it was easy to move, work with, level, and it drains well. If you are in very cold conditions or wish to grow tropical plants, consider under floor insulation as well. You can even build on solid rock by drilling in and epoxying metal pins into the rock then putting your cement foundation over the pins.

LEVELLING THE SITE

Use a laser level or long straight board on edge pinned to the ground

in the center of the site with your 4ft-6ft level placed on top. It's very important to get the site level; because an unlevel site will often make an unlevel foundation that can put undue stress on your dome.

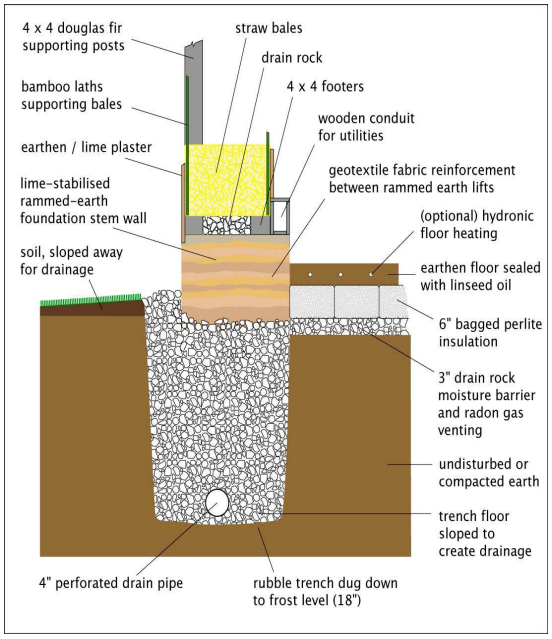


Decide on a Perimeter Foundation

Treated wood, rock, cement, or brick are all good options. The main thing is to have a flat (ideally raised if you have groundwater issues) surface to attach your dome to. Another good foundation is a trench, filled with gravel. Usually called a rubble trench and used extensively by famous architect Frank Lloyd Wright.
If you do this type of foundation take the time to put a drain pipe under the gravel to take any ground water away from your site. We decided to go with 6" cement blocks like this placed onto a 2"x12" trench filled with cement.

The blocks will be filled with cement where rebar stakes the bricks to the ground and the places where we will install the foundation bolts with the remaining voids

filled with coarse sand. Then we will bolt the first level of struts (plastic 2x4's) on the flat to become the lowest level of the dome.



Building the Cement Brick Foundation

DOUBLE CHECK YOUR CALCULATIONS!!! Measure your marked out foundation again and make sure your calculator is spitting out the actual size of foundation you have laid out before you cut any struts!

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Tools and Materials Required

- appropriate number of bricks for your foundation – for the stem wall
- 10 bags premixed cement and gravel – for stem wall foundation (ideal for first timers or those without a truck or trailer)
- 2-3 bags type 10 Portland cement – for the stem wall foundation (ideal for experienced builders or those looking to save money)
- 1 yard navvy jack – to mix with cement (ideal for experienced builders or those looking to save money)
- cement mixer – to mix cement (or mix directly in the wheelbarrow by hand. Takes longer but better control and less tools required.)
- short level – to level the bricks
- rubber mallet – to tamp the bricks down
- wheelbarrow – to mix and move cement
- shovel – to shovel cement
- rake – to level and finish under cement foundation
- rubber gloves – to protect your hands from cement
- water – to mix cement
- hoe – to mix cement in wheelbarrow

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Dig trench that extends below the frost line in your area (check the Google for that info) then, if less than 4 inches, fill with cement mixed at a ratio of 14 scoops navvy to 2 scoops type 10 Portland cement with just enough water to get it to mix. Keep it “dry”! The less water in the mix the stronger the finished cement. If your perimeter trench is deeper than 4" then fill with crushed stone, loose rock, broken cement or what have you then cap with gravel and the do a 3" cement cap foundation on top.

While the cement foundation is still moist settle your bricks in to a depth of 3/4" using your measuring stick from your central pin to establish the correct placement for each brick that will give you your correct sized foundation. Use a rubber mallet to settle the bricks in and your short level to keep them level. Using rubber gloves mound up the cement on both sides to slope up to the base of the brick, this will stop water pooling under your bricks and potentially heaving them up if it freezes.

Check level from your central pin as well (raised up to account for the height of the bricks of course). Decide where you would like your door to be and leave out bricks the appropriate width (less than one strut and directly under a 5 way

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hub so that the triangles on each side of the door are the same size). Cover the bricks with plastic to keep the cement moist while curing.

Installing the Rebar

Tools and Materials Needed

- leather gloves
- 15 – 2' x 3/8” rebar (get it pre cut for you or buy cut offs) – to pin foundation to ground and stem wall
- hammer or small sledge hammer

Next day you can go back and pound 2'x3/8" rebar down through the openings of the bricks ever 4th brick or so till the rebar is below the bricks top surface. Then when all the rebar is pounded down you fill those cavities (that have rebar) in the bricks with cement.

Mortaring the Cracks

Tools and Materials Needed

- 3 bags premixed brick setting mortar (sand and cement) – to fill gaps in bricks (ideal for novice builder)
- 1 bag cement – to make mortar mix (ideal for experienced builder)
- ¼ yard masonry sand – to make mortar mix (ideal for experienced builder)
- wheelbarrow – to mix mortar
- hoe – to mix mortar
- small trowel – to apply mortar

Because you are using rectangular bricks to make a circle there will be small gaps between the ends of the bricks. Make a mix of 2 masonry sand to 1 Portland cement and trowel these gaps full. Use rubber gloves and push the mortar into all the voids to make a continuous foundation. After filling the gaps with mortar cover with plastic again.

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Applying Foundation Sealer

Tools and Materials Needed

- 1 gallon latex based foundation sealer – for sealing foundation
- paint can tool (free from paint department) – for opening can
- 3” paintbrush – for application of sealer
- water– for clean up

After a few days of curing, cover the outside of your foundation with foundation sealer. This prevents any surface water from coming through your foundation and makes it look tidy at the same time. I was able to do my entire foundation with 1 gallon of foundation sealer. Start low on cement foundation and work up to the top of the bricks on the outside only.

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Final Confirmation of Foundation Size

(Not using a foundation? Ignore this step)

Tools and Materials Needed

- 2 C struts and 1 B strut with metal tabs properly inserted (see strut and strap instructions to make these)
- 2 – 3/8” x 1-1/4” hub bolts (see fastener instructions to order these)
- 25' tape measure
- carpenters pencil

Before you cut all the struts make SURE that your base struts will fit your foundation and that your foundation is the right size. To this end, I suggest making up some test struts (2 C struts and a 1 B strut with a hole to hole length as specified by the calculator) complete with tabs bolted in. Bolt them together and to end, and use that as a guide (mark start, slide the three struts around on top of your foundation as if they were all the struts from the base of your dome marking each hub location as you go and see if you come back to the start nice and even.

This step will make sure your foundation is the right size. Of course if you are not using a cement foundation you can ignore this section too!

Build a test batch of struts 2 C's and 1 B with metal tabs and bolt them together. Place these flat on the foundation, mark where each bolt comes out then slide along and repeat till you return to your starting point.

The first mark you made should match up with the last bolt hole after the last move. This is done to confirm that your foundation is the right size for your dome. If not tweak your calculations, adjust your test struts until the math works and the struts come out bang on when marking and moving them around the foundation.

KEEP YOUR EYE ON THE PRIZE!

BUILDING THE STRUTS

Tools and Materials Needed

- truck or utility trailer for moving materials (or have them delivered)
- ear muffs
- respirator or dust mask
- eye protection
- gloves
- 25ft tape measure
- hammer
- chisels (1 good and 1 beater)
- carpenters pencils and sharpie marker
- wheelbarrow
- extension cord or generator if you are in a remote location
- 4 saw horses or work bench
- drill press (ideally), power drill (OK), or powerful cordless drill with lots of batteries (not ideal)
- table saw (ideally), corded skill saw (OK), or powerful cordless skill saw with lots of batteries (handy but not ideal)
- table saw (ideally) or skill saw (OK)
- metal chop saw (ideally but only if you are going to do the metal tabs yourself), or skill saw with 2 x metal abrasive blades (OK)
- compound miter saw (ideally) or skill saw (OK)
- drill press (ideally), good size corded drill (OK) or 18v cordless with LOTS of batteries and a way to charge them (not recommended but will work)

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- 4" or larger angle grinder
- bench vise or big C-clamp
- multi bit screw driver
- cordless drill or corded drill with #6 Robertson bit
- center punch
- 2 medium crescent wrenches
- 2 X 9/16” socket with 2" extension and driver
- 9/16” wrench 2 X 7/16” 1/4” socket and driver
- 7/16” box end wrench
- 2 x C clamps
- hand saw
- 2 x 3/8” drill bits
- 3 x 5" 1/4 drill bits
- 1 x adjustable square
- 3" paintbrush

MATERIALS:

- appropriate number of plastic 2x4's for the size dome you are building – for the base of your dome
- appropriate number of Spruce, Pine, Fir (SPF) utility grade 2x4's in lengths that divide well into your strut lengths – for all the rest of your struts
- metal tabs (either 17 x 20ft 1/8" x 1-1/2" hot rolled flat bar as raw material or two pre-cut and drilled 10" tabs per strut from the steel store. Do it if you can afford it!) – for the hub system
- 66 3/8” x 1-1/4” galvanized hex head bolts – for the hub system
- 66 3/8” galvanized hex nuts – for the hub system
- 140 3/8” galvanized washers – for the hub system
- 2lbs 3" #6 Robertson ceramic coated coated deck screws – for screwing stuff

- 1lb 1-1/2" #6 Robertson ceramic coated deck screws – for screwing stuff
- 1/2lb 16 penny galvanized box nails – for nailing stuff
- 665 1/4" x 4" galvanized hex head bolts or go to 3-1/2" and countersink the heads on the outside for a cleaner look – for the strut ends
- 665 1/4" galvanized nuts – for the strut ends
- 1400 1/4" galvanized washers – for the strut ends
- 3 10" abrasive cut off blades for metal cut off saw or 4 8" abrasive cut off blades for Skillsaw – for fabricating the metal tabs
- 2 4" cut off metal cutting blades for 4" angle grinder – for fabricating the metal tabs
- 2 grinding disk for the small angle grinder – for grinding metal
- 1x2" wide paint brush - for touching up the stain
- Drill Dr. unless you can sharpen drill bits by eye (I can't!) - optional but very useful and a great tool to have!

WHEW! That's a killer list! Remember many of these tools you may only need a couple of times. So think about borrowing or renting. Also if you are serious about being self reliant, DIY or prepper YOU NEED TOOLS!! So never feel bad picking up new tools. UsedWhereYouLive.com, Craig'sList.org and Kijiji.com as well as HarbourFreight.com are great resources for bargains on tools. Even if a tool isn't top quality if you only need it a few times a year it can last you a lifetime so don't be afraid to pick up tools! Remember most times your partner will never even notice a new tool! But a new Harley? No way Jose!

So lets do this!

Before you even go to the lumber yard design your dome on paper and write down all your strut lengths. These will be hole to hole remember so your actual 2x4's will be a bit shorter.

Sizing Materials

Once you have your strut lengths play around fitting them into standard lumber lengths (8' 10' 12' 14' 16' etc.) What you will find is, there are certain boards that will “match up” with your struts better than others. In order to save money its best to figure out the most efficient use of the 2x4's. So if you have an 8ft 2x4 that is 96 inches thus you could get two struts that were less than 48 inches long out of one 8 footer. Take some time, write down all your figures and figure out the most efficient use of lumber for the size struts your dome requires. Once you know those numbers that tells you how many of each length 2x4 you will be buying.

Once you have figured out the number of 2x4's you will need go ahead and order all your fasteners. I suggest getting three quotes from online suppliers like
www.wholesalebolts.com
www.boltproducts.com
www.lightningbolt-nut.com
(I found them to be 1/3 the price of the lumberyard) but if there is a specialty fastener store in your area check there too. When I ordered my bolts the local store was only a couple of percent more expensive than the cheapest online source and I could pick the bolts up the next day with no shipping. Nice!

The steel tabs are made from 17 pieces x 20ft 1/8'' x 1-1/2'' hot rolled flat bar as

raw material or to think of it another way, you need two pre-cut and drilled 10" tabs per strut. So as we have 165 struts in a Kruschke dome we would need 330 10in metal pieces with a 10-10 degree bend 1-3/4" from the end and a 3/8th hole drilled exactly ¾" inch from the same end.

Confirming Strut Lengths and Making Test Struts

At this point I suggest making six tabs (10" long with a 10 degree bend 1-3/4" from one end and then a 3/8th inch hole drilled exactly center ¾" and ¾" in from that same end) for the three test struts. Once you have your tabs made up you will need to cut your struts to length. I will talk as if you have a compound miter saw and if you are using a Skillsaw follow along as best as you can.

STRUTS		ANGLE
30 X "A"	120.343	9.49°
35 X "B"	139.536	11.02°
80 X "C"	153.843	12.16°
20 X "D"	160.985	12.74°
165 STRUTS	Calculate	Clear Values

You have decided on your dome diameter, maybe even built your foundation, now go back to the calculator and look at the actual strut lengths. It should look something like this: Note: these numbers are in centimeters because I found that easier when doing the exacting cuts required. Feel free to use ft and inches but remember fractions make your hair hurt!

Remember also, all measurements are hole to hole and our tabs are going to stick out of the end of our 2x4 struts by 1-3/4" or 4.5cm on each end so an A strut from the calculator shows up at 120.34cm hole to hole including the tabs so we minus 4.5cm on each end which leaves us with 111.34cm for the 2x4 portion

of the strut.

Do the same with the other strut numbers based on what your dome calculator gives you. Write the 4 numbers down for your A, B, C, and D struts. Now double check your numbers again. When you are confident that you are in good shape go ahead and cut a B and two C struts with the appropriate angles as per the calculator. Cut the B strut with 11 degree angles on each end and the C struts with 12.15 degree angles on each end.

Prepped Struts Ready for Bolting

Once you have the three test struts cut with the right length and angles on each end then move on to the next phase which is ripping a slot in each end for the metal tab.

Ripping the Slots

The slot needs to be 1/8th inch wide and long enough to accommodate the unbent portion of the metal tabs. On my table saw this meant that the end of the 2x4 just got to the edge of the table of the saw. Use your metal tab as a guide or rip your slot a bit longer than you might need so, if the metal is 10" long and you bend it at 1-3/4" then you would need a slot 8" deep to accept the unbent portion. Note: because you are using a circular saw blade it will cut deeper on one side. You could do the cut with a sawzall or hand saw but I found that even though the cut was a bit deeper on one side it still worked fine. Just remember and account for the different depth of cut on either side of the strut.

Here you see a 4 way hub with three tabs inserted into the slots, all the bolts in place and the steel tabs bent.

After you have your slots ripped the right depth now its time to finish your metal tabs if you haven't already. Once you have your 6 tabs with the 3/8th inch hole dead center on the short bent part, tap the unbent part into the slot, one on each end then measure center to center on the holes in the metal tabs. This measurement should be EXACTLY what the calculator gave you for that type of strut. Confirm that the strut is “centered” on the two tabs (equal amount sticking out each end), double check the hole to hole distance, then drill two ¼" holes for the other bolts, install the bolts and try bolting your triangle together with the 3/8th inch bolts!

If it doesn't fit go back and check the steps again. If the ends of the 2/4's are

touching a bit and making it hard to align the bolts use your beater chisel and remove a bit of wood to allow them to come together tighter.

I found that some of my hubs were perfect and some needed a bit of “massaging” with the chisel to go together. If you are super accurate and detail oriented you will have way less problems but the way I see it if I can build one of these than you can too! Even if we have to do a bit of “creative carpentry” with the chisel!

DOUBLE CHECKING YOUR FOUNDATION SIZE

Now you have a triangle that has its tabs installed and consists of two C's and a B go ahead and open it up so it all lays flat, lay it centered on your foundation, mark where the first hole sits, mark the last hole, then slide the three struts around your foundation till the first hole lines up with the last mark and repeat till you come back to where you started. This simulates the base struts being laid on the foundation. If you come out plus or minus an inch you are golden, if out by 8-10 inches, as I was the first time; head back to the calculator and double check everything.

Including the fact that you must multiply your calculated dome circumference .982247 to get your actual foundation size if you are using the Domerama.com calculator with the 3v Fuller-Kruschke dome. Because the calculator puts out a circumference for the dome as if it was cut exactly in half not truncated at 5/9 as it is.

So make sure you multiply your circumference number by 982247 to get your foundation size BEFORE you build your foundation! Or if, like me you have already built your foundation then you will need to adjust your input numbers on

the dome till the output for “circumference” equals EXACTLY what size you have in front of you, make your test struts, confirm they fit and massage the numbers until they all work perfectly.

PRODUCING YOUR STRUTS

Once you have confirmed that your foundation is the right size using both calculator and actual struts. You are now ready to go ahead and produce your struts. To do that follow the exact same steps you used to make your three test struts only this time do as many things as you can to improve efficiency. Some of the ways I did that are listed here:

Use templates and temporary guides!

Whenever you can, come up with a way so that you don't have to measure! Confirm the measurements EXACTLY in the beginning then use the jig to cut all the rest of your struts. You will be faster and not have to measure each time.

Once you have your jig perfected measure your first strut to confirm it is coming out the right length. Obviously you will have to adjust your jig when you start each new length of strut. Here is a picture of my jig for cutting the wooden parts of the struts on the chop saw. This will work with a skill saw too. What is hard to see in the right of this picture is the angled block (the part that was cut off after the first cut) is now screwed down to form a “stopper” when you go to cut the other end of each strut. You must confirm the length of your blade

to the stopper in order that your struts come out the right length.

Cutting the Slots Review

Once you have your struts cut to the right length the next task is cutting the slit to accept the metal tab. In my case I didn't need a template because the edge of my table saw was the right distance. So, when I started cutting the slit, when the end of the strut hit the end of the table I was done. The main thing is that your slit is long enough that you have some adjustment after you insert the metal tab. Therefore it should be 8-1/2 inches into the end of the strut and exactly in the center of the 2x4 to make assembly easier later.

Here you can see some stained struts with metal tabs installed prior to being drilled and bolted. The biggest thing with the slit is because the saw blade is curved you need to cut the slit deep enough to allow the shortest side of the cut to be 8-1/2" deep. Here is an example showing how the blade makes a cut to get you on the right track.

Once you have confirmed the slot is cut to the right depth you are ready to install the metal tab.

Installing the Metal Tabs

Take a hammer and tap the metal tab down into the slit leaving the bend about a 1/4" out from the end of the 2x4 end and flush on both sides. At this step make sure that the metal tab is at a 90 degree angle to the angled end of the 2x4 strut, that way when you bolt them together later the angles will match up and keep the dome near to spherical.

Once the tab are inserted in each end of the strut measure hole to hole on the metal tabs and confirm that your hole spacing is EXACTLY what the calculator is outputting. Remember your 2x4 strut will be shorter than the length output by the calculator by 3-1/2". I suggest you set up a template for measuring the hole to hole spacing as you will need to do that measurement many times. I used deck screws measured exactly and some scrap 2x4 to hold the strut. After inserting the 2x4 into the template use a hammer to adjust your tabs till the head of the deck screw (that you measured to match the calculator values) line up EXACTLY with the holes in the metal tabs. Measure your first few struts hole to hole on the tabs to confirm that your template is accurate. Once it has been confirmed you are ready to go on to the next step.

Bolting the Metal Tabs

Now your hole to hole length is set take a 1/4" drill bit and after confirming that you will be drilling through the the 2" side of the 2x4 rather than the angled end, drill through the strut on the 4" axis. You can drill the wood and the metal with the same metal bit, but you must back the bit out every 1" to 1-1/2" to let the shavings escape. Drill slowly and steadily don't force the bit but use firm pressure while cutting through the metal tab. It may bind a bit as it clears the

metal, this is normal just keep pressing on.

Once you have the two holes through the metal tabs drop in your 1/4" galvanized hex head bolts and confirm the hole to hole distance again. If everything is still correct for length go ahead and do the same for your one B strut and two C struts. Once your struts are complete get your 3/8ths galvanized hex head bolts and bolt the struts together to confirm that all the angles are right and then you are ready to go into production.

Strut Production Line

The first struts you will need to produce are the plastic base struts. There will be 15 plastic base struts, 5 B struts and 10 C struts. Go ahead and do assemble those struts now.

Special notes for working with plastic lumber

The main things to remember when working with the plastic lumber is that the shavings and sawdust may glom together and even melt if it is not able to escape. My tablesaw had a very small opening at the bottom to let out the sawdust and it had clogged up so when I started ripping the plastic 2x4's the plastic sawdust almost caught fire inside the saw. So make sure it is able to escape from your cutting tools. Also the plastic while reasonably inert isn't something you want in your soil so try and capture all this material for proper disposal in the garbage otherwise you risk adding even more micro plastic pollution to your soil and food.

Once you are ready with your plastic base struts now you can go ahead and manufacture all the other struts! First cut the (after double, triple and quadruple checking all your numbers) 2x4 portion of your A, B, C and D struts. As you are

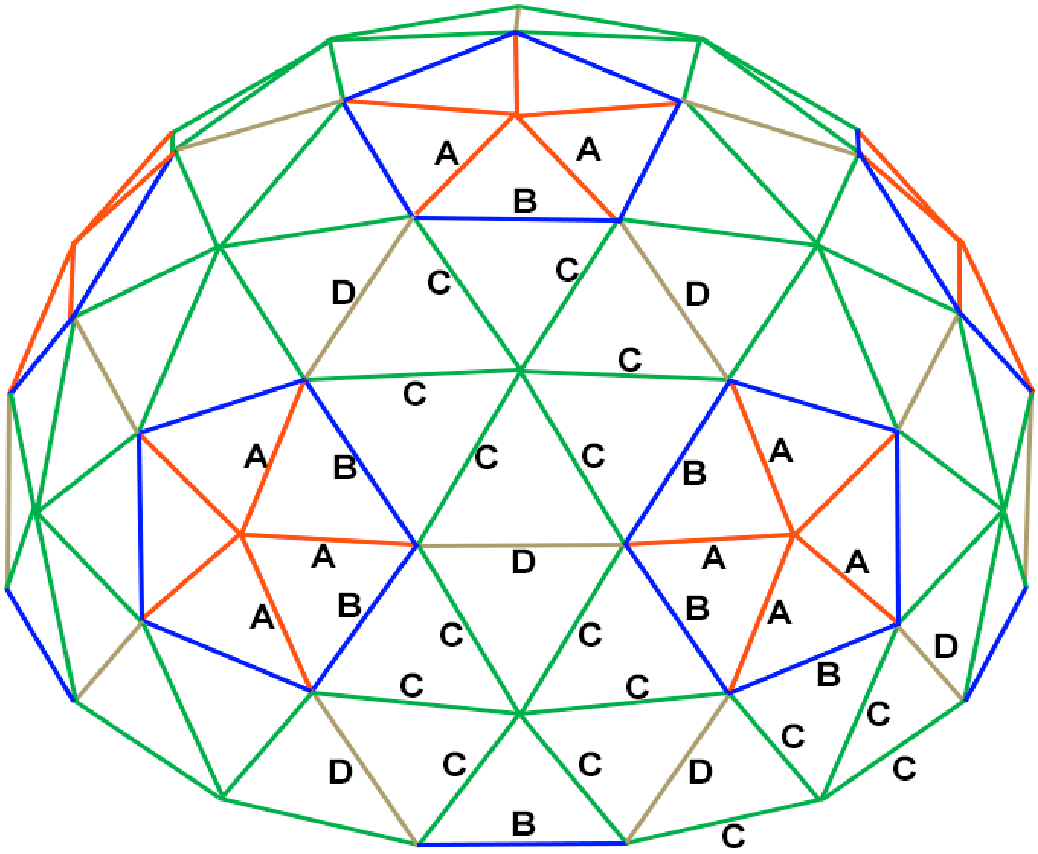
cutting your struts, double, triple and quadruple check your lengths! Use templates! Use angled stoppers to make sure that the angles are correct for each strut. Once you have all your struts cut to length with the appropriate angle on each strut rip your 8-1/2" slot into each end of each strut again confirming that the tab will fit snugly and still leave 1-3/4" sticking out. When you are assembling your struts make sure that the metal tabs are sticking out equally from each end as you set the hole to hole measurement.

Staining Your Struts

Once you have all your struts cut. Find a dry, warm, covered area and do two coats of low VOC stain on all the wooden struts. The plastic we leave unpainted. We used two gallons to do the struts on our dome and started out by dipping each end of each strut into a bucket of stain to get maximum uptake on the end grain. This will leave your strut not quite as pretty but will make a longer lasting finish. Use a roller and paintbrush to make sure the stain penetrates evenly into all the cracks, knots and the tab slots.

Now that the 2x4 struts are done go ahead and prep the rest of your metal tabs. I used a metal cutoff saw to cut my tabs to length, drilled them on a small drill press in batches of 6 tabs at a time, then bent them by eye in a bench vice. It took about a day to prep all the metal tabs including grinding off all the rough edges on a bench grinder. You can have your tabs cut and the 3/8ths hole drilled at the metal fabrication shop or metal dealer. It will cost you more up front but save you a bunch of time at the end.

THE EASYDOME SYSTEM



Print This Assembly Diagram! Or upload to your tablet for later.

By Sasha LeBaron
www.GeodesicGreenhouse.org

Now that the tabs and struts are prepped and ready to be assembled and have confirmed your foundation (if you are going to use a foundation) is the right size. Note: Even if you aren't using a foundation the dome assembly will be the same, the difference is that once you have your dome frame assembled you need to use bent rebar set in concrete to hold your dome to the ground because if the wind picks up enough, anything will blow away.

Rebar Bender

DIY Rebar Bender and bent rebar over bottom strut (for larger domes you would use a large blob of cement on each side instead of just pounding it into the dirt for this type of hold down.)

THE EASYDOME SYSTEM

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THE EASYDOME SYSTEM

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ASSEMBLING YOUR EASYDOME FRAME!

Tools and Materials Required

- Prepared struts
- scaffolding
- 16ft orchard ladder
- socket set
- wood chisel
- hammer
- tape measure
- friend
- drinks for celebration when the frame is up!

Plastic Base Strut Assembly

Start with the plastic base struts and make the entire bottom of the dome.

Remember the order B-C-C until you get back to where you started. Don't tighten the 3/8th bolts at at this point. Confirm that you are following the assembly diagram .

Assemble the Rest of the Easydome Frame

Next you will put up the D-C-C-D vertical struts and connect loosely with the 3/8th inch bolts. If you are having any trouble getting things to fit together this is where you will use a chisel to relieve the edge of the 2x4 strut to allow the metal tabs to come together nice and even. This is why you do the test struts before

manufacturing the rest. If you have an alignment problem or other issue the time to correct it is when you have only made 3 struts not when you have all of them done and are ready to start building your dome.

After the first set of triangles are up the next step is to put the horizontals in place, then more verticals, and continue (following the assembly diagram which I suggest you copy to your tablet or print out the assembly diagram).

As you assemble your EasyDome frame you will need to use a 3/8" deep socket to tighten the nut at each hub. As you assemble your geodesic greenhouse frame you will need to start using scaffolding to reach the higher levels. If you are making a dome smaller than 24ft in diameter you will most likely need to take apart a lower triangle to get your scaffolding out at the end or wait until you have made your door opening.

Bolting the Tabs Together

Continue to assemble your dome following the assembly diagram. If you run into

problems with tabs not being close enough together to get the last tab on use your socket driver to tighten all the tabs together and expose enough of the threads to get the nut started.

For the base there will be 15 struts, two C's then a B. In other words there should always be two C struts between each B. You will need 5 B struts and 10 C struts for the base of your biodome. Remember the bottom row of struts are plastic!

Begin with lowest level of your dome to assemble triangles. Leave bolts a finger tight to assist in assembly then tighten after each level of the frame is complete. If you run into trouble with being able to fit the tabs to the bolt chisel off the edges of the two by four struts where they are touching this will give you the room to fit even the 6 way connectors no problem.

Of course the more precise you are with all the previous steps the less trouble you will have at this stage. When assembling the metal tabs onto the 3/8" bolts tighten down the nut with a ratchet between adding each successive tab and also "flatten" the hub a bit to allow the bolt to grip the tabs already installed. This prevents the tabs spreading away from each other as you add successive tabs to the pile.

When you get to the sixth tab install only the nut and compress all the tabs together then back the nut off and install the washer. Have a friend help with the upper levels and use two sections of scaffolding. As you work your way up attaching the struts the dome will become more and more rigid till when you finally put in the last five A struts at the top your frame will be almost totally rigid. Confirm that all nuts are tightened and take pictures!!

Double check that all nuts are tightened and if you are feeling really paranoid use Loctite blue thread lock.

YAHOO!

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THIS NEXT STEP IS REALLY IMPORTANT!

Before you start installing the foundation tie down bolts confirm dome frame is aligned on foundation and the door is appearing where you want it too. If you have a cement foundation like we made, you must confirm the location of the hub that will be removed for the door BEFORE you install the foundation anchor bolts and commit yourself to a specific location. Because the dome frame is rigid but light it can be rotated on the foundation even after it is completely assembled. You will need a couple of people or a come-a-long to help you but it is doable if needed.

Once you have aligned your dome EXACTLY over the door opening

We chose to have remove a C-C hub with a B strut directly above on the horizontal that left two A struts to the right and left over our door but you can put it any where you want

really. We chose that place for our door because when you stand back and look it comes out symmetrical. Once you have done this use a lever and fulcrum or a jack to lift the dome and place 2x4 blocking on each side of each base hub.

Now use cedar shingles as wedges and go around and around adjusting the frame till it sits exactly level on the foundation.

Flattening the Base Struts

After you have the dome frame raised up, oriented over your door opening and level, use a large pipe wrench with a piece of pipe slipped over the handle to increase the leverage to adjust the angle of the plastic bottom struts. To do this grab the strut as near to the hub as you can. Using a firm pressure twist the strut and metal tab till it is parallel with the top of the foundation. This step is important to get the base struts flat in relation to the foundation before installing the foundation tie down bolts.

INSTALLING FOUNDATION ACHOR BOLTS

Tools and Materials Required

- 30 6" x 1/2" foundation anchor bolts and nuts
- wrench or socket to fit
- 3/4" spade bit
- drill
- extension cord
- tape measure
- pencil

Now Double Check the Dome Alignment on the Foundation.

Drill 3/4 inch holes and pound two foundation bolts with nut on top (but no washers yet!) per base strut, let the bolts hang down into voids in the blocks. During this step make sure your nut is all the way to the top of the foundation bolt so that when the nut is pounded down flush into the plastic 2x4 of the base strut there will still be enough thread sticking up after the wooden lifting blocks have been removed.

Once all the bolts are in fill around foundation bolts with a rich mix of 2 cement to 6 navvy mix and tamp down till cement "puddles" on the top and is level with the top of the cement blocks. Fill the remaining voids in the block wall with gravel, sand or cement if you are worried about freezing and cracking. Then do some clean up or go home for the day and spend time with your family or on other projects while the cement dries for a MINIMUM of a full 48hrs preferably 72!

Lowering the Easydome Frame

Once the cement is dried knock out the wooden blocks and using your body wieght on the plastic struts near each hub gently jump up and down to drop the dome (as gently as you can!) down onto the foundation. This will leave your bolts sticking up above the plastic base struts, add a washer to each foundation

bolt and gently tighten. We are not trying to crush the plastic just prevent it from taking off! Also the plastic will shrink and expand with temperature so this is why we drilled the holes oversize. Confirm all hub bolts are tight but not crushing the plastic base struts!

DOOR FRAMING

Tools and Materials Required

- hand saw
- 4-6ft level
- drill gun
- robertson bit
- 1-1/2" robertson deck screws
- skill saw
- 2 sheets 1/2" plywood
- table saw
- 2x4's as long as your D struts to be ripped into nailing strips
- tape measure
- hammer
- saw horses
- plumb bob (optional)
- pencil
- angle finder
- framing square
- roofing square
- 3" robertson deck screws
- step ladder
- socket set

This is the trickiest part of the build so if you know a carpenter now is the time to do a work trade or break out the check book!

THE EASYDOME SYSTEM

Layout and Bracing

Decide on the height of your door and make a mark on the two A struts above your head and measure to the apex. Rip a 2x4 into to 2-1/2" pieces and cut it to fit inside the mark and up to the apex on both sides. Install one of the ripped 2x4 "nailing strips" with 3" deck screws making sure there is enough room so that the 1/2" plywood will sit flush. Hold up a piece of plywood (or measure) and mark it for size. Cut the plywood triangle, install the other nailing strip and screw in your plywood with 1-1/2" deck screws. Place a level under the plywood triangle you just installed and make a level line on both A struts. This will be the top of your door frame. Put the plywood gussets around the door by ripping a 2x4 to 2- 1/2" screwing it to the inside of the strut, placing one edge of the half sheet of plywood on the block you just installed, hold it with a screw then go on the inside and mark with a pencil, remove, cut the triangle, install the remaining 2-1/2" blocks to the other sides of the triangle and screw your 1/2" plywood triangle in place. If your lines or cuts were off and the triangle doesn't fit then recut and try again.

By Sasha LeBaron
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THE EASYDOME SYSTEM

Remember this is rough carpentry not cabinet making! Once the two-side plywood gussets and gusset directly above the door are in place above and to the left and right of the door opening, you can cut the horizontal B strut exactly in the middle then unbolt the wood from the metal end and put it aside for later, then grab your 6ft level and start laying out your door.

If you have left a gap for a door then the corner of this gap will be the point that you will start from. If not you can measure your door height based on how tall you would like it to be. This will be measured on the A struts above the B horizontal strut.

Once you have decided where you are starting your layout from (in our case from the foundation up) place the level vertically on the plastic C strut above the cement foundation and mark a line where the level crosses the C strut above.

Do the same on the other side of the C strut then connect the lines using a straight edge. Note the lines and resulting cut will be at a compound angle and will need to be made with a hand saw.

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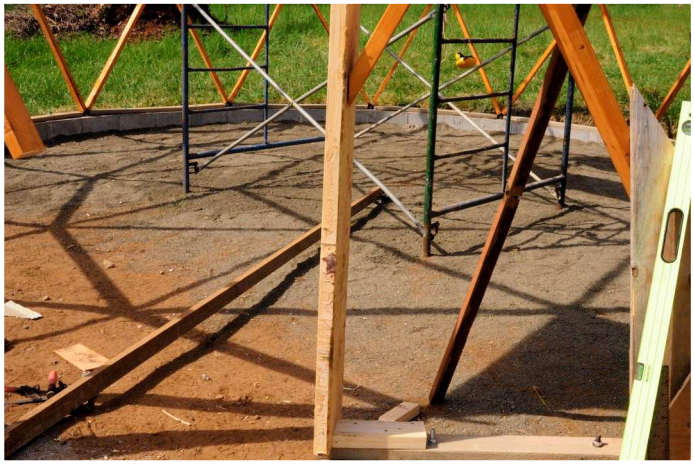
Making the Cut



Confirm all lines are plumb (level in the vertical orientation) and that if you place a 2x10 vertically (as a door frame) it will "hit" the B strut above and still sit cleanly on the foundation plastic C strut.

Once you have confirmed these things you can go ahead and cut the first angled C strut. Now that you have the C strut cut you can do a rough cut of the opposite side C strut BUT leave it long, you will be cutting it again! Now remove the hub that was in the center of the door and now you can walk into your dome!

Installing the Door Frame

Now that you have your door opening use the 2x10 to frame in the door cutting the corners off where they intersect with the angled struts above

THE EASYDOME SYSTEM

the door. Make sure you take your time as this is a challenging step. You can also use a piece of solid foam to make a template of the cut you will need to make then transfer it to the 2x10.

Once you have your first 2x10 in place and plumb repeat on the other side.

Now you should have two plumb vertical sides of the door opening. Measure cut and screw the cut off B struts to the door frame and reassemble the bits you unbolted of the horizontal struts.

By Sasha LeBaron
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Once the vertical parts of your door frame is in, rip the appropriate width off a piece of 2x10 to make a flat top to your door frame that juts out from the plane of the dome. This will be covered in metal flashing to provide rain protection to the door and frame as well as giving the door some definition.

Door Frame!

Make sure you have a block flat on the plastic bottom strut to screw into at the bottom. This gives a nice solid base to the door frame.

Finishing the Door Frame

Trim your door frame top (the horizontal 2x10) to about 2" longer than your door is wide then cover with metal flashing. Start about 6" up on the plywood, come down across the top of the door, bend it down over the edge and back behind in a 1/8" fold to make a drip edge that will let water fall out away from your door.

Now that the top of the door opening is in covered it with metal flashing making sure it extends up along the plywood gusset by at least 6" inches to prevent water from getting behind it. The two layers of tarpaper will later cover this.

BUILDING THE ACTUAL DOOR (OR USE A PRE MADE DOOR)

Tools and Materials Required

- table saw
- skill saw
- 3" deck screws
- cordless drill and driver for screws
- hinges
- 2" screws for hinges
- stapler
- staples (1/2" galvanized)
- hammer
- chisel
- pencil
- tape measure
- step ladder
- 2x4's for building door

THE EASYDOME SYSTEM

Building the Door

Now using 2x4's you can build your door. Make the door frame on flat ground, cut triangular braces for the corners, screw the frame together, stain, then wrap with plastic and staple or fill with foam and cover with plywood for more weather protection. I designed and built my own latch but a standard gate latch will work as well (make sure you drill a hole and have a STRONG string to the inside otherwise you may end up having to escape through a vent!)

When cutting the corner triangle braces make sure the grain runs parallel to the longest side so that you will have less cracking when screwing into them.

Don't forget to inset your hinges to allow your door to close nice and tight to the door frame. Once everything is in place stain it all and you are ready to move on to building vent frames.

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THE EASYDOME SYSTEM

BUILDING THE VENT FRAMES

Tools and Materials Required

- table saw
- skill saw
- 3" deck screws
- cordless drill and driver for screws
- hinges
- shorter screws for hinges
- stapler
- staples (1/2" galvanized)
- shrink-wrap or UV stable greenhouse plastic
- 2x4 as long as D struts to be ripped down to make sides of vent frame
- 1x4 as long as D struts to be ripped down to make the reinforcing
- heat gun
- 20lb propane tank
- leather welders gloves gauntlet style
- saw horses
- pencil
- skill saw

The vent frames will be made of 1-3/4" material (2x4 ripped in half) screwed together at the corners, hinges added and covered with shrink-wrap.

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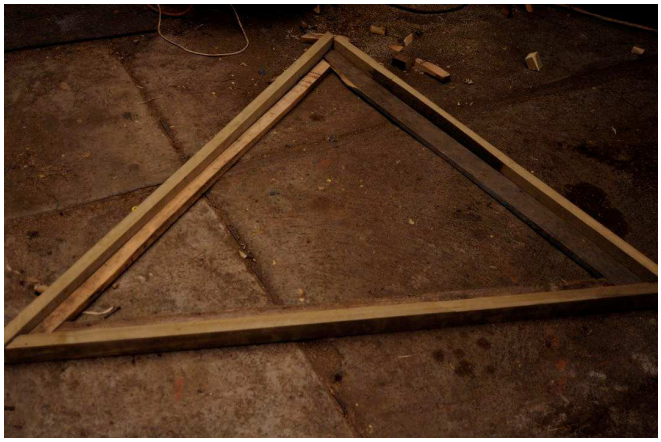
THE EASYDOME SYSTEM



When making these triangular frames the inside brace is needed because if you are using the shrink-wrap it will bow in the sides like crazy. So after holding your 1-1/2" x 1-1/2" ripped piece up to the triangle on the dome it will then fit into, mark and cut the angles and repeat on the other 2 sides of your vent frame. When each piece looks good temporarily screw it together and hold it up. If it doesn't fit unscrew and trim appropriately. Once you have the triangle vent frame fitting well, use the 1x4 on edge fastened with deck screws to keep the sides reasonably straight when you apply the shrink-wrap.

Once your frames are made up. Install hinges and repeat on the other vent frames you are building. These dome greenhouses are so efficient that if you get any significant sun you will need at least two bottom vents and one on top to keep your plants from overheating in the summer months.

After you have your vent frames installed you are ready to put in the north side insulation and stucco.

By Sasha LeBaron
www.GeodesicGreenhouse.org

THE EASYDOME SYSTEM

INSTALLING NORTH SIDE INSULATION

Tools and Materials Required

- tape measure
- pencil
- box cutter or electric carving knife or fine tooth saw
- hammer
- 2lbs 1-1/4" galvanized common nails
- as many 1/2 by 1/2" strips ripped from 2x4 as there are sides on triangles to be insulated
- 3" solid expanded polystyrene or blue closed cell foam as needed for the amount you are planning to insulate

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WARNING! Boxcutter knives are razor blades! BE CAREFUL!

In our case we decided to go with solid 3" polystyrene for the north side insulation.

Install Nailing Strips

The foam is held in with 1/2" x 1/2" wooden strips ripped out of scrap 2x4 and nailed in with galvanized nails.

Install nailing strips on the inside edges of all the triangles you intend to fill with solid foam.

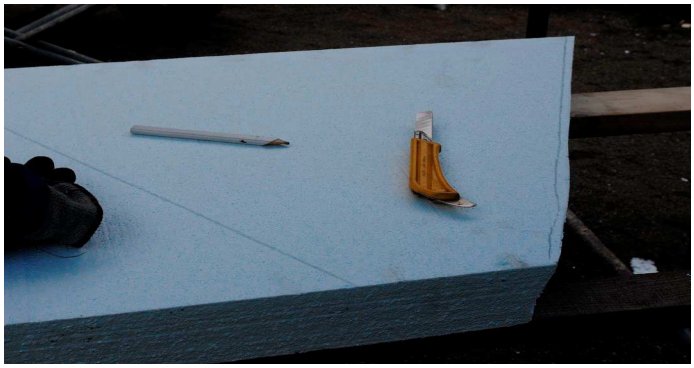
Installing Solid Foam

Tools and Materials Required

- sufficient for your desired area to be covered 3" by 24" by 8' EPS foam (the cheapest stuff you can get) or better yet find it used!
- tape measure
- pencil
- saw horses
- box cutter
- straight edge

Hold the foam on the outside of the triangle. Mark then cut using a utility knife making sure to cut at an angle to match the triangles. This allows the foam to fit securely into the triangles. One could glue the seams but I chose not to for reasons of not wanting to become covered with industrial adhesive and spend

the day huffing fumes. When cutting the panels I used a box cutter razor knife and managed to get it done without slicing myself BUT **BE CAREFUL!** More people are hurt with box cutters than almost any other tool on the job site! Always know where your other hand is and make multiple shallow cuts rather than straining to try and do it all in one cut.



Remember that the dome triangles are slightly angled so cut a corresponding angle on the sides of your foam then press into place up against the nailing strips you installed before.

STUCCO LAYER

Installing Tarpaper and Burlap

Tools and Materials Required

- box cutter
- tape measure
- step ladder
- staple gun or "hammer tacker"
- 3 rolls of 30 minute rated tarpaper
- 2 3' by 100' burlap call and get the cheapest you can www.burlapfabric.com
- 5000 "pro-pack" of the longest staples your gun will accept

THE EASYDOME SYSTEM

After installing all the foam into the triangles cover the outside of the insulated portion of the dome with two layers of tar paper again starting at the bottom and overlapping (by 6") each successive sheet over the one below. Use lots of staples! Every 2 inches along the struts every foot from bottom to top. Wrap the tarpaper up to your door frame and over the flashing above the door frame.

Once the tarpaper is in place staple on two layers of burlap (the kind you would use to wrap plants that don't want freezing. Use lots of staples! Every 2 inches along the struts every foot from bottom to top. You can get burlap from landscape supply place or nursery. Keep the burlap as tight as you can as you go. In the middle you will be stapling into the foam but it will hold if you use long staples and then when the stucco goes on it holds everything together as a solid shell over the foam.

Installing the Stucco

Tools and Materials Required

- 2.5 gallon plastic bucket
- drill gun or corded drill
- drill mounted paint mixer
- 5 gallon bucket
- water
- 3 5 gallon buckets of Grancrete HFR Magnesium Oxide Cement
- 4" paint brush
- step ladder
- plant sprayer

By Sasha LeBaron
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You can use regular Portland stucco with stucco wire or use the modified stucco we did. Now you are ready to stucco using the Magnesium Oxide cement Grancrete HR from www.grancrete.net we used 3 five gallon pails of the high temp stuff to give our dome even more protection.

Put the dry Grancrete in a bucket and using a stiff wire bent into a loop and used in your drill for mixing, start adding water while mixing, till the mix becomes like smooth thin pancake batter. Apply with a paintbrush. You may find you get better results by pre-wetting the burlap with another brush or greenhouse sprayer with water in it. Make small batches of Grancrete!

Depending on the temperature it will set in 60 minutes or less so be warned. Wash your brush after every batch and aim to saturate the burlap on the first coat (scratch) coat. The next coat(s) seal and waterproofs. Once the scratch coat rings hard when you tap it you can apply the second coat.

Once you have all your burlap covered with AT LEAST two coats of Grancrete or regular stucco making sure you have no holes, voids or places where you can see the burlap. And your stucco is dry you are ready to move on to the shrink-wrap.

SHRINK-WRAPPING THE DOME

Tools and Materials Needed

- **at least 1 assistant!**
- NO WIND! This is important. You must have less than 5mph wind to do the shrink wrap safely and efficiently
- shrink wrap 1 17'x100' roll clear, 6mm UV stable from www.DrShrink.com
- shrink-wrap gun, regulator, hose and all accessories
- instructional DVD **WATCH IT FIRST!**
- 6ft extension for finishing the top of the dome
- full 20lb BBQ sized propane tank
- 24ft extension ladder
- leather gauntlet gloves
- long sleeve 100% COTTON shirt (synthetic burns almost as fast as skin)
- 25 x 3/4x3/4" strips of wood as long as your bottom D struts
- galvanized 2" common nails
- hammer
- scrap 2x4 for blocking bottom of ladder and making a rest for leaning on dome after shrink-wrap has been installed

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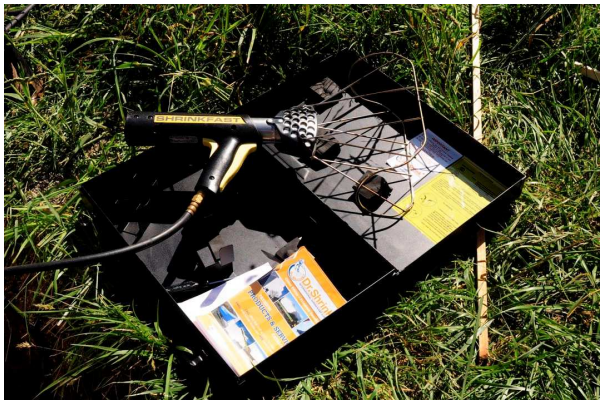
- step ladder
- hose or other source of water and fully charged ABC Dry Chemical fire extinguisher
- tape measure
- clean space 20'x100' (put down tarps if needed or dry grass is OK) to lay out shrink-wrap
- box cutter
- staple gun and box of galvanized staples
- 1 rolls UV resistant clear tape for patching small holes and covering staples that must be left in place www.tapesandtech.com
- 2 pieces of 24" x 1/2" rebar for holding base of ladder (much better to use an assistant!)
- foam or bubble wrap to pad 2x4 that goes against dome after shrink-wrap has been placed
- angle grinder with grinding disk
- 1 roll of heavy duty duct tape



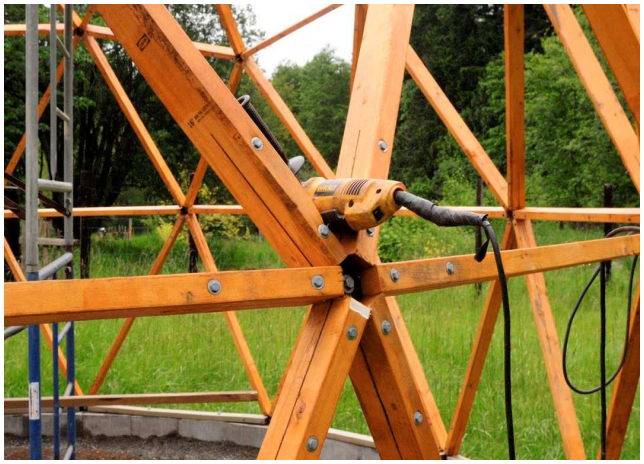
The shrink-wrap we used worked great
BUT....
BEFORE YOU DO ANY SHRINK-WRAP. WATCH THE VIDEOS! DO SOME PRACTICE FIRST! AND KEEP A FIRE EXTINGUISHER AND A HOSE NEARBY AT ALL TIMES!!!
The shrink-wrap plastic and your struts are flammable and if you overheat them, they can catch fire. This is a drawback but we believe that the benefits outweigh the risks and that with proper practice and safety precautions it can be used safely.

Note for Those Using Greenhouse Plastic

Or if you are going with greenhouse plastic then use that instead. But if you do use lots of galvanized or better yet stainless steel staples! Every two inches is best because when the wind gets under your plastic you are done for and what prevents that is tons of staples! And consider instead of taping over the staples afterward use rubber tape first then staple through that to seal the two holes that get punched through the plastic each time you put a staple in.

Even consider renting an electric staple gun. Also remember that the plastic, either shrink-wrap or greenhouse plastic must go on from the bottom up to allow water coming down to continue to the ground rather than getting under the layer below. This is the shingle principle and if you do decide to use greenhouse plastic I suggest taping over all the struts with the most aggressive UV stable tape you can find to help seal the staple holes which WILL leak.

From now on I will assume you are using shrink-wrap. If not go ahead and skip this section. Install outer shrink-wrap covering on all sides in temperate climates or on the south side only in colder or higher elevation locations.



(Ideally pay for this step to be done watch as the professional does it in 1/4 the time you could and with 90% less mistakes!).

If you are doing it yourself MAKE SURE YOU follow ALL the instructions from whomever you rented the heat gun from and watch the DVD!

As soon as the stucco is on and dry (this is a huge benefit to the Grancrete; it dries in one day!) you can start applying the shrink-wrap. Before you apply the shrink-wrap make sure you grind down the high points of all the struts at the hubs. Use the grinding disk on the angle grinder and make sure you do them all!

Once this is done cover all bolt heads (unless you got fancy and counter sunk them) with a strip of heavy duct tape. This will protect the shrink-wrap from the bolt heads during the shrink process. Make sure you use only one color of duct tape because you will see it later. I like silver cause it looks spacey!

After this step… CONFIRM ALL BOLTS ARE TIGHT! Don't go crazy on them just make sure they are tight as this will be the last time you can easily get at them. Once that is done. Cut a piece of shrink-wrap plastic that spans from vent to vent and covers the first and lowest row of triangles with 8" of excess top

and bottom. Wrap the top over the horizontal struts and temporarily staple on the inside of the dome to hold it in place.

Rip (or buy pre-cut battens) 3/4" square by the length of your base struts, battens out of 2x4 or other material and roll the plastic around the batten and nail to the base of the dome. When you are coming down onto the stucco area use the same technique too. Now that the bottom is secure go back and take out the slack from above. Wrap the plastic around the horizontal struts and staple underneath. Once the plastic is in place and reasonably tight and free of wrinkles... remember it shrinks by up to 25% so you don't have to stress about getting it super tight.

SHRINK IT! This is fun but be CAREFUL! Heat once and move on don't keep re-heating the same spot otherwise the shrink-wrap will become thinner and thinner and eventually a hole will appear. (It will happen so just accept it, patch it and move on).

Once the first layer of shrink-wrap is in place repeat above only leave 8" hanging down over the top of the layer you just installed, this gets heat sealed to the previous layer and then tensioned from above as before, then heated. Some of the upper layers will need to have relief cuts made. Here I made the cut and stapled into the strut then covered my staples with more shrink-wrap and heat sealed it after.

Note: The clear tape that comes with from Dr. Shrink is NOT UV stable and will

only last about a month in direct sunlight! SO us UV stable tape for small holes and patch any large holes you make with another piece of shrink-wrap. If you have to patch in the middle of a triangle cut a full triangle and go out to the edges where you have something to press against to heat seal.

After the lowest level of heat shrink is on, work your way up in this manner until all you have left is the very top of the dome and that can be done in one big piece. This one is tricky so be extra careful and keep your scaffolding set up inside for your assistant to help you.

Use the long ladder, make a pad so you can lean in safely on the struts of your already covered dome and have a friend hold the ladder at the base or use a scrap 2x4 with holes drilled through and rebar pounded into the ground to prevent the ladder slipping out.

Once you have access to the top of the dome, use staples to hold the piece in place and heat seal the bottom edge all around then put on your heat gun extension and CAREFULLY heat shrink the last of your dome. YAHOO! Almost done!

By Sasha LeBaron
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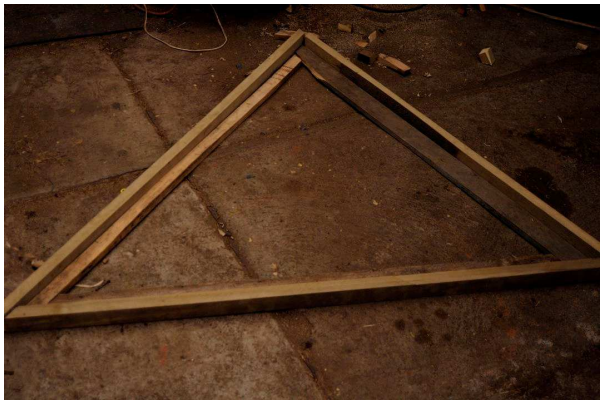
Vent Frame Heat-Shrink Covering



Now complete your vent frames if you haven't already. Install the hinges and get them fitting nicely in the triangles then remove and cover with heat shrink and shrink them. Remember if you don't use a 1"x3" on edge as a brace inside the shrink-wrap will bow in the sides of your vent frames and they will look funny and won't fit properly.

Installing Roof Vent And Prop

Put in your roof vent on the down wind side (of the prevailing summer wind). Use a bent piece of sheet metal (I used a Simpson strong tie joist hanger modified) and a small bolt to create a "hinge" for a prop with slots cut in it every two inches that will hold the vent up and allow for manual adjustment. You can also use a wax filled automatic vent opener if it is strong enough for your vent panel.

By Sasha LeBaron
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The advantage of the manual system is that you can easily fully open your vent for summer heat. Once the prop is installed modify another Simpson joist hanger to act as a catch for the slots you cut into your prop. And don't forget to install a strap to hold the vent from blowing away and a block to prevent it from falling in if you loose control of it when you are lowering it. (Learn from my mistakes!)

Installing Inside Plastic (for cold climates)

Tools and Materials Required

- 1 roll UV stable greenhouse plastic or 6mil vapor barrier plastic (cheaper but may have writing on it)
- two sections of scaffolding and platforms
- 24ft ladder
- staple gun
- 5000 pro-pack 1/2" galvanized staples
- hammer
- felt tip marker
- tape measure
- box cutter
- clean dry place to lay out plastic for cutting

By Sasha LeBaron
www.GeodesicGreenhouse.org

THE EASYDOME SYSTEM

When installing the inside greenhouse plastic it is better to start from the top and work your way down so water tends to stay on the outside of the plastic rather than dripping on you when condensation forms or you have a leak. Measure and cut a template piece of plastic for each type of triangle you will be covering. A-A-A, A-C-C, etc. Start at the very top and cut triangles two inches larger than needed, align, staple in place and cut off excess plastic. Repeat till you reach the ground, being careful not to cut the already installed plastic or the shrink-wrap!

Once the inside plastic is in you can start adding automatic vent openers, grow beds, hydroponic systems, aquaponic systems etc. But first...

HAVE A DOME WARMING PARTY!

After that we put in a rocket mass heater grow bed, infloor heating, Reflectix, a brand of aluminum-coated insulation/heat reflector and a cement floor throughout. Then you can look at installing thermal heat sinks from water tanks. Build grow beds with optional under soil heating ducts, or move straight to an aquaponic system or vertical garden. Research LED grow lighting and solar fan. Build and install rocket stove bed heater (if needed in your area). Plant! Eat! Have fun! Test, tweak and retest.

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THE EASYDOME SYSTEM

Consider a HOBO greenhouse data logger to keep track of temperature, sun exposure, humidity etc. also LED grow lights are a great investment for those of us in the frozen north. Consider a C02 Generator for higher yields as well as biological pest controls like lady bugs for aphids for example.

You can even use chickens or rabbits to keep your dome warm while using scraps and making manure! Remember to keep the manure cleaned out though! The high levels of ammonia in animal poop will kill plants if enough builds up.

By Sasha LeBaron
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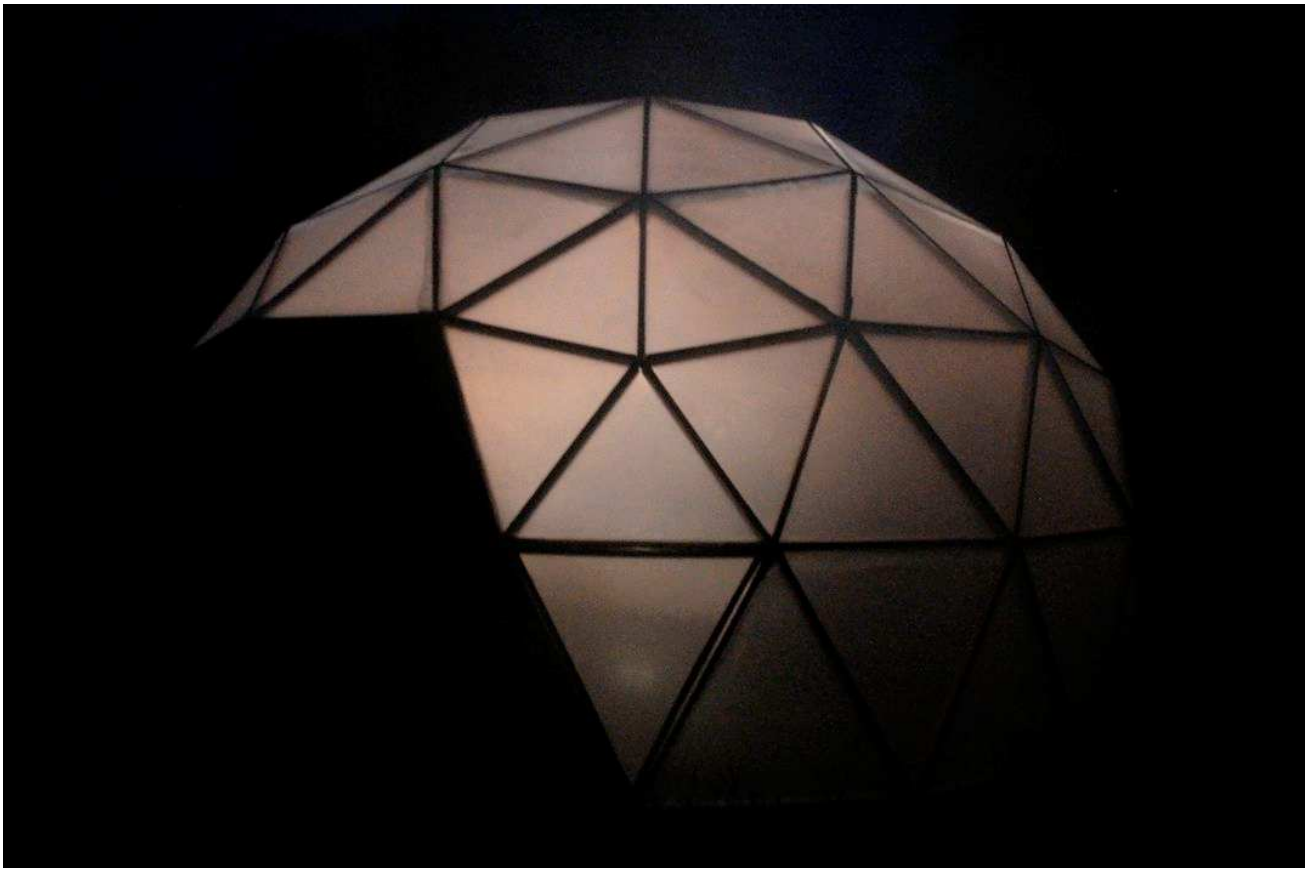
THE EASYDOME SYSTEM



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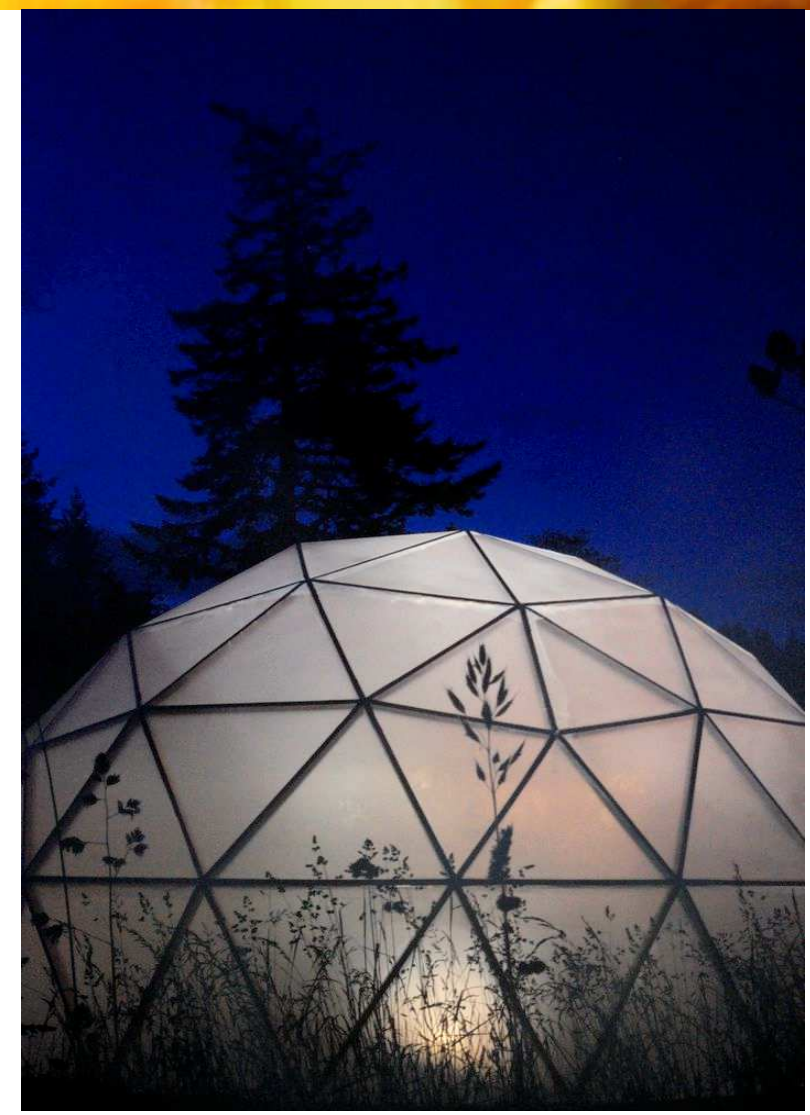
THE EASYDOME SYSTEM



NEED MORE ASSISTANCE?

Pick up the Eden Biodome Revolution Package as well.

By Sasha LeBaron
www.GeodesicGreenhouse.org

It outlines this exact dome build with FULL VIDEOS of all steps and comes with live customer service to answer all your technical questions.
Or post your questions directly to me at the blog www.GeodesicGreenhouse.org

Meanwhile: Happy Building!

Sasha

Appendix 1

TOOLS

- truck or utility trailer for moving materials
- ear muffs
- respirator or dust mask
- eye protection Gloves
- 25ft tape measure
- carpenters pencils and sharpie marker
- hammer
- chisels (1 good and 1 beater)
- 100ft tape measure (optional but very useful for checking foundation size, measuring plastic, etc.)
- level 4'-6' ideally
- shovel
- leaf rake
- garden rake
- wheelbarrow
- mattock
- digging bar
- spray paint or lime for marking
- rubber mallet 12"-14"
- orchard ladder or very stable step ladder
- 24ft extension ladder
- scaffolding 4 frames, 4 X braces and planks (rent it! You can thank me later!)

- cement mixer
- wheelbarrow and hoe
- extension cord or generator if you are in a remote location
- 2 five gallon buckets
- garden hose or water source
- small trowel
- 4 saw horses
- table saw or skill saw
- metal chop saw or skill saw with 2 x metal abrasive blade
- compound miter saw or skill saw
- drill press or good size corded drill or 18v cordless with LOTS of batteries and a way to charge them
- 4" or larger angle grinder
- bench vise or big C-clamp
- multi bit screw driver
- cordless drill or corded drill with #6 Robertson bit
- center punch
- tin snips
- 2 medium crescent wrenches
- 2 X 9/16” socket with 2" extension and driver
- 9/16” wrench 2 X 7/16” 1/4” socket and driver
- 7/16” box end wrench 14" pipe wrench
- T50 staple gun
- 2 x C clamps
- sharp hand saw
- 2 x 3/8” drill bits
- 3 x 5" 1/4 drill bits
- 1 x 3/4” spade or speed bit
- 1 x 6" bullet level

- 1 x framing square
- 1 x adjustable square
- 3" paintbrush

OPTIONAL but great to have tools

- shop
- welder
- bench grinder
- full time assistant
- self levelling 5 beam laser level
- landscaping rake

MATERIALS:

- 3 x 5000 staple boxes of 3/8" T50 staples
- 2lbs 3" #6 Robertson ceramic coated coated deck screws
- 1lb 1-1/2" #6 Robertson ceramic coated deck screws
- 1/2lb 16 penny galvanized box nails
- appropriate number of (sorry you do have to do a bit of math!) 6x16" cement blocks (I used 65)
- 3 bags of type 10 regular Portland cement or you can use the premixed sand, gravel cement in bags. More expensive but easier to use.
- 3 buckets of Grancrete HFR (if you are going to do the burlap magnesium oxide stucco)
- 2 gallons of low VOC exterior latex deck stain
- Two 3-1/2foot x 100 foot rolls of burlap (used for wrapping trees in freezing

weather) check at you local nursery
- 1 bag of premixed mortar with sand
- 1 yard navvy jack or get ready mix and save your back!

NOTE: THESE 2x4 NUMBERS ARE FOR A 24FT DOME!! Do your own math anyway. Or order lots and send back what you don't use.

- 25 16' 2x4's
- 18 14' 2x4's
- 12 12' 2x4's
- 16 10' 2x4's
- appropriate number of plastic 2x4's for the lowest level of the dome
- 18 20foot 1/8" x 1-1/2" hot rolled flat bar cut into 10ft lengths for moving or get it pre-cut to 10" lengths to make your life a lot easier but a bit more expensive.
- 30 3/8" foundation bolts with washer and nut
- 66 3/8" x 1-1/4" galvanized hex head bolts
- 66 3/8" galvanized nuts
- 140 3/8" galvanized washers
- 665 1/4" x 4" galvanized hex head bolts or go to 3-1/2" and countersink the heads on the outside for a cleaner look
- 665 1/4" galvanized nuts
- 1400 1/4" galvanized washers
- 3 10" abrasive cut off blades for metal cut off saw or 4 8" abrasive cut off blades for skillsaw
- 2 4" cut off metal cutting blades for 4" angle grinder
- 1 grinding disk for the small angle grinder
- 4' of 10" wide or greater flashing
- 4 rolls of 30minute tarred building paper
- 1x 4" wide paint brush (if you are using Grancrete)

- 1x2" wide paint brush for touch up stain
- Drill Dr. unless you can sharpen drill bits by eye (I can't!)
- 1100 sf UV stable vapor barrier
- 17x100 roll of 6ml (or heavier if you can get it) UV stable clear shrink-wrap
- 2 rolls clear UV stable Tape from www.tapesandtech.com
- 1 shrink-wrap heat gun with 6' extension (you will have to rent this one or better yet pay someone to do the Shrink-wrap for you as it can be tricky and a bit nerve wracking)
- large fire extinguisher and hose for use when doing the shrink-wrap
- bottle of champagne
- appropriate number of glasses

APPENDIX 2

Web Resources:

www.geodesicgreenhouse.org
http://www.biodomerevolution.com/
www.domerama.com
www.youtube.com
www.burlapfabric.com
www.tapesandtech.com
www.wholesalebolts.com