When I say "geodesic dome" what do you think about?

FUTURISTIC HOMES, SCHOOL YARD JUNGLE GYM – OR GREENHOUSES?

Ted Craig with the Wyoming Department of Agriculture and Jeff Edwards with the University of Wyoming Extension have presented workshops about and have built hoop houses – structures with vertical half-circle ribs – as season-extending structures for 10 years.

Now, they're focused on geodesic domes and triangles.

Craig and Edwards aren't bent out of shape by the switch. This past year they received several requests from schools to build geodesic dome "greenhouses" for educational workshops.

They accepted the challenge after some research because:

- Finished projects are very tidy.
- Domes are structurally sound and will hold up to Wyoming weather.
- They have similar farmable amounts of space as hoop houses for approximately the same cost.
- The workshops provide an inexpensive DIY alternative to purchasing what can be very expensive pre-manufactured dome kits.
- Individuals using domes to grow produce indicated managing temperature extremes is easier than with traditional hoop houses.

Craig and Edwards have outlined some of the basic information related to building and using geodesic domes in Wyoming to get you thinking about the potential in your area.

Knowledge gained from geodesic build workshops around the state will hopefully lead to easy-to-follow building plans and instructions that will be included in a future issue of *Barnyards & Backyards* magazine.

A geodesic dome with a split door.

Angles, angles, angles

In contrast to traditional construction that uses squares and rectangles, dome construction requires the use of various triangles and multiple compound angles. Remember high school geometry? Most don't. Fortunately, there are apps available to help out. For example, Geometryx for android phones can be used to calculate strut length and angles. The website bit.ly/geodomecalculator assists in calculating basic lengths, angles, and generating a materials list.

You may also need to use a decimal feet to fractional inch calculator, bit.ly/decimalstofeet.

One frequent term you will run across is, well, "Frequency," which refers to the repetition of a pattern of triangles used to approximate the surface of a dome or sphere. Just remember, the higher the frequency, the greater the number and pattern of different-sized triangles.

You'll see 2V, 3V, 4V, 5V, 6V to describe the frequency in different domes. The 2V is the least complex, making it the least expensive, and also the least round. By contrast, a 6V (Frequency 6) dome uses more triangle sizes, is more complex, is more rounded, and is a much stronger structure.

Hubs and couplers

You may also see or hear reference to "hubs" or "couplers." Although not required in building a dome, they are used to simplify connection of the struts and eliminate compound angles at the joints.

We chose the 2V design, a 21-foot diameter structure, with 3-inch Schedule 80 PVC couplers, regular 2x4 studs fitted with hanger bolts, and woven polyethylene greenhouse

Geodesic – where did that come from?

Geodesic has Greek origins. Geo means earth, particularly its spherical shape. Desic means to measure. The literal translation of geodesic is to measure the earth. Leonardo Da Vinci investigated and designed structures that could be assembled that were "self-supporting," meaning built without lashing individual pieces together. Some of his designs included dome structures of this style. More recently, the late German engineer Walther Bauersfeld (1879–1959) was credited with building and patenting the first modern geodesic dome; however, because of the Second World War, the design was only rediscovered in 1948 by Richard Buckminster Fuller, an American architect who coined the term geodesic dome and popularized them.

A hanger bolt that has been screwed and glued into the strut. The end you see will be placed through a drilled hole in the hub.

A dome connector (grey hub). The threads of the metal hanger bolt in the strut pass through one of the drilled holes of the hub and are attached using a Nylock nut.

An exploded view of several 2 x 4 struts with hanger bolts and the dome connectors.

plastic as the standard for the educational workshops.

A 21-foot diameter dome has 10 sides and approximately 346 feet of farmable space. The dome materials cost approximately $1,500 and can be prepped for building in 8 to 10 hours (the more you build the more efficient you become).

Prepping the structure involves cutting and drilling the PVC connectors, cutting and assembling the 65 struts – (30 pieces cut from 2-inch x 4-inch lumber at 65½ inches in length with 16 degree miter angle cuts on each end and the second strut (35 pieces cut from 2 inch x 4-inch lumber at 74½ inches in length with 18 degree miter cuts) of which all 65 pieces are affixed with 3-inch hanger bolts on both ends. The dome base is also built.

Once the site is leveled (very important!), the dome skeleton can be erected in two to four hours. Skinning (attaching plastic covering) and finishing takes an additional four to eight hours. A recent dome project (from unloading supplies to finishing the skinning) in Ethete was completed in nine hours by two instructors and half a dozen volunteers.

Other than the greenhouse plastic and louvered vents, which you will have to order from a greenhouse supply company, all materials can be purchased at a local hardware store. There are also dome greenhouse kits available on the internet from various companies if you are willing to pay the price.

Geodomes available to view

If interested in seeing a dome greenhouse structure on the ground, there are two in Casper, and one each in Arapahoe, Ethete, Evanston, and Afton. Contact the University of Wyoming Extension offices in Casper, Fort Washakie (for Ethete or Arapahoe), Evanston, or Afton to see the geodomes in their respective towns.

The Casper and Ethete projects were awarded to schools via the Wyoming Department of Education (WDE). The others were funded through a specialty crop grant awarded to the UW Extension. Additional WDE projects in Wheatland and Sheridan are scheduled for construction this year.

For further information, contact Edwards or Craig.

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Nearly completed dome frame. Red struts are the shorter "A" struts with 16 degree angles on both ends. Blue struts are the longer "B" struts with 18 degree angles on both ends.

Completed structure in the Casper Veterans Garden.

Interior of completed and producing dome. (All photos courtesy Ted Craig, Jeff Edwards.)