How to Build A Lloyd Turner Balloon Form

We are dedicating this page to the do-it-yourself balloon form dome builder. Owner / builder domes are possible, especially for those who want to build their own airforms.
The founders of Monolithic Dome were originally exposed to balloon forming by Lloyd Turner. Lloyd was one of the original pioneers of air form construction. After learning from Lloyd, Monolithic Dome then went on to develop their own system with higher pressure and proprietary rebar holders. Their system is okay, but requires more expensive balloon forms. The upside of the MD forms is that they that are durable and weather resistant.

One benefit to low pressure forming is the ability to sculpt and shape the forms. Sometimes it is as easy as stapling a seam in a slightly better line as Lloyd did in his own home. If you are interested in the natural ways domes can nest similar to bubbles on a soap dish, then low pressure forming is an excellent choice to consider.

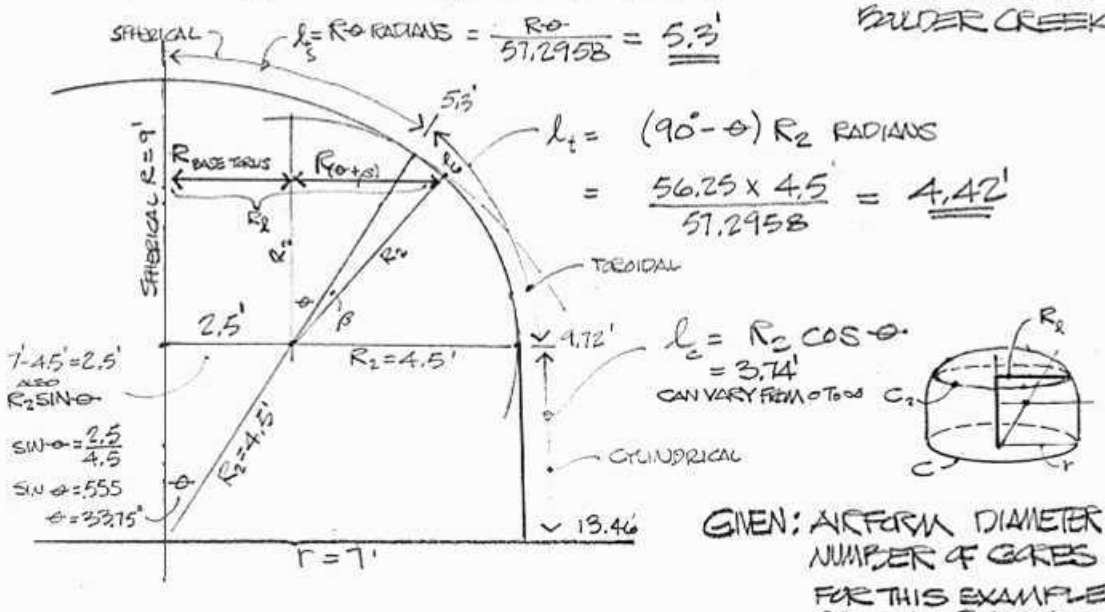
If you want a single large dome over 30″ diameter or for bulk storage, the Monolithic Dome airform style could be a better choice.

For thin shell dome engineering and review of construction styles, we strongly recommend Chris Zweifel at ZZ Consulting.

The drawings below are the derivations for a torispherical airform and a hemispherical airform.

TORISPHERICAL AIRFORM

LLOYD TURNER
BOULDER CREEK, CALIF.



GIVEN: AIRFORM DIAMETER = 14', HT. 9'
NUMBER OF GORES = 18

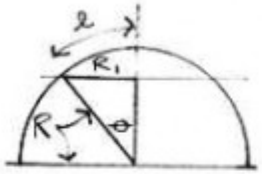
FOR THIS EXAMPLE ASSUME THE SPHERICAL R TO BE TWICE THE TOROIDAL R_2

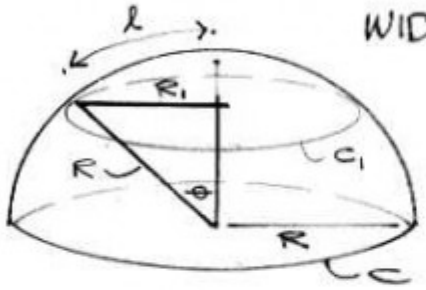
METHODOLOGY . . THE IDEA IS TO DEVELOP A NUMBER OF HORIZONTAL CIRCLES FORMED BY PLANES CUT THRU THE SPHERICAL TOP AND PARALLEL TO THE BASE. FOR THIS TOP PORTION THE PROCESS IS EXACTLY THE SAME AS IF CALCULATING THE GORES OF A LARGE HEMISPHERE. AS THE DISTANCE DOWN FROM THE APEX INCREASES, THE SHAPE CHANGES FROM SPHERICAL TO TOROIDAL AND THE CONFIGURATION OF A VERTICAL SECTION CUT THRU THIS PORTION CHANGES FROM A CURVE WITH A LONG RADIUS TO ONE WITH A SHORT RADIUS. BY COMBINING SOME OF THE GEOMETRY OF BOTH SEGMENTS, MORE HORIZONTAL CIRCLES SIMILAR TO THOSE DEVELOPED IN THE TOP PORTION ARE DEVELOPED IN THE TOROIDAL PORTION. THESE ARE THEN DIVIDED BY THE NUMBER OF GORES USED IN THE AIRFORM TO GIVE THE WIDTH OF EACH GORE AT VARIOUS POINTS ALONG ITS LENGTH . .

HEMISPHERICAL AIRFOIL

LLOYD TURNER
BOULDER CREEK, CA

METHODOLOGY: THE IDEA IS TO DEVELOP A NUMBER OF CIRC
FORMED BY PLANES CUT THRU THE HEMISPHER
AND PARALLEL TO ITS BASE, THESE WILL
EVER LARGER AS THEY MOVE DOWN FROM TH
DIVIDE EACH OF THESE CIRCLES BY THE NU
OF GORES USED TO MAKE THE AIRFOIL TO F
WIDTH OF EACH GORE AT VARIOUS POINTS ALONG





STEPS

① FIND CIRCUMFERENCE AND R
$C = 2\pi R$ OR $R = \frac{C}{2\pi}$
OR $C = WN$ ← NUMBER OF GORES × MAX. GORE WIDTH

② FIND WIDTH OF EACH GORE AT THE BASE
$W = \frac{C}{N}$ OR $\frac{2\pi R}{N}$

③ FIND ANGLE θ (THETA)
$\theta = \frac{\ell}{R}$ ← SELECT ℓ
$\frac{\ell}{R}$ GIVES YOU θ IN RADIANS
1 RADIAN = 57.2958°

④ FIND R_1
$R_1 = R \sin\theta$ ← TRIGONOMETRY

⑤ FIND C_1
$C_1 = 2\pi R_1$
$= 2\pi R \sin\theta$

⑥ FIND W_1 ⇦ HERE'S WHAT WE'RE AFTER
$W_1 = \frac{C_1}{N}$ WHICH EVOLVES INTO

EXAMPLE

LET NUMBER OF GORES = N = 16 @ 55" EACH = W

① $C = 16 \times 55" = 880"$ GORE LENGTH =
RADIUS = $\frac{C}{2\pi} = 140"$ OR $\underline{11.67'}$

③ ANGLE θ AT $\ell = 1'$ = $\frac{\ell}{R} = \frac{1}{11.67} = .0857$ RAD
$.0857 \times 57.2958 = \underline{4.9°}$

④ $R_1 = R \sin\theta = .997'$; $\times 12 =$

⑤ $C_1 = 11.96 \times 2\pi = \underline{75.16"}$

⑥ $W_1 = \frac{75.16"}{16} = \underline{4.7"}$

FOR EACH ℓ REFIGURE ③④⑤
OR COMBINE THE ABOVE STEPS INT

$W_\ell = \left[\sin\left(\ell \cdot \frac{57.2958}{R}\right)\right] W$

$W_1 = \left[\sin\left(1 \cdot \frac{57.2958}{R}\right)\right] 55" =$

$W_2 = \left[\sin\left(2 \cdot \frac{57.2958}{R}\right)\right] 55" =$

OR COMBINE THE ABOVE INTO

$W_\ell = \left[\sin(\ell \cdot K)\right] W$

More information on **Thin Shell Concrete**.