

Thin-shell Concrete Quasi-spherical Small Buildings: Durable, Low-cost, Low-Earth impact, Global Shelter

Now \$ 600 K scale-up to
human-useful size

We have solution

Bill Leighty, Principal
Alaska Applied Sciences, Inc.
Juneau, Alaska
wleighty@earthlink.net
Rev: 22 April 26

Juneau, AK 1974: 16' diameter concrete dome: $\frac{1}{2}$ " thick, $\sim \frac{5}{8}$ sphere

**Quasi-spherical thin-shell concrete
Monococque (single piece)**

Global climate change protection:

- Extreme temps
- Storm
- Fire
- Flood, earthslide



Problem # 1 Global Climate Change accelerating

- Extreme Temps
- Storm
- Fire
- Flood
- Sea level rise
- Earthslide

Tornado Alley



Problem # 2 Stick-built is obsolete

Stick-built, Gable-roof

- Weak, roof blows off
- Combustible
- Costly: many pieces, labor
- Hard to insulate
- Cannot Earth-shelter
- Insurable ?

Better
way



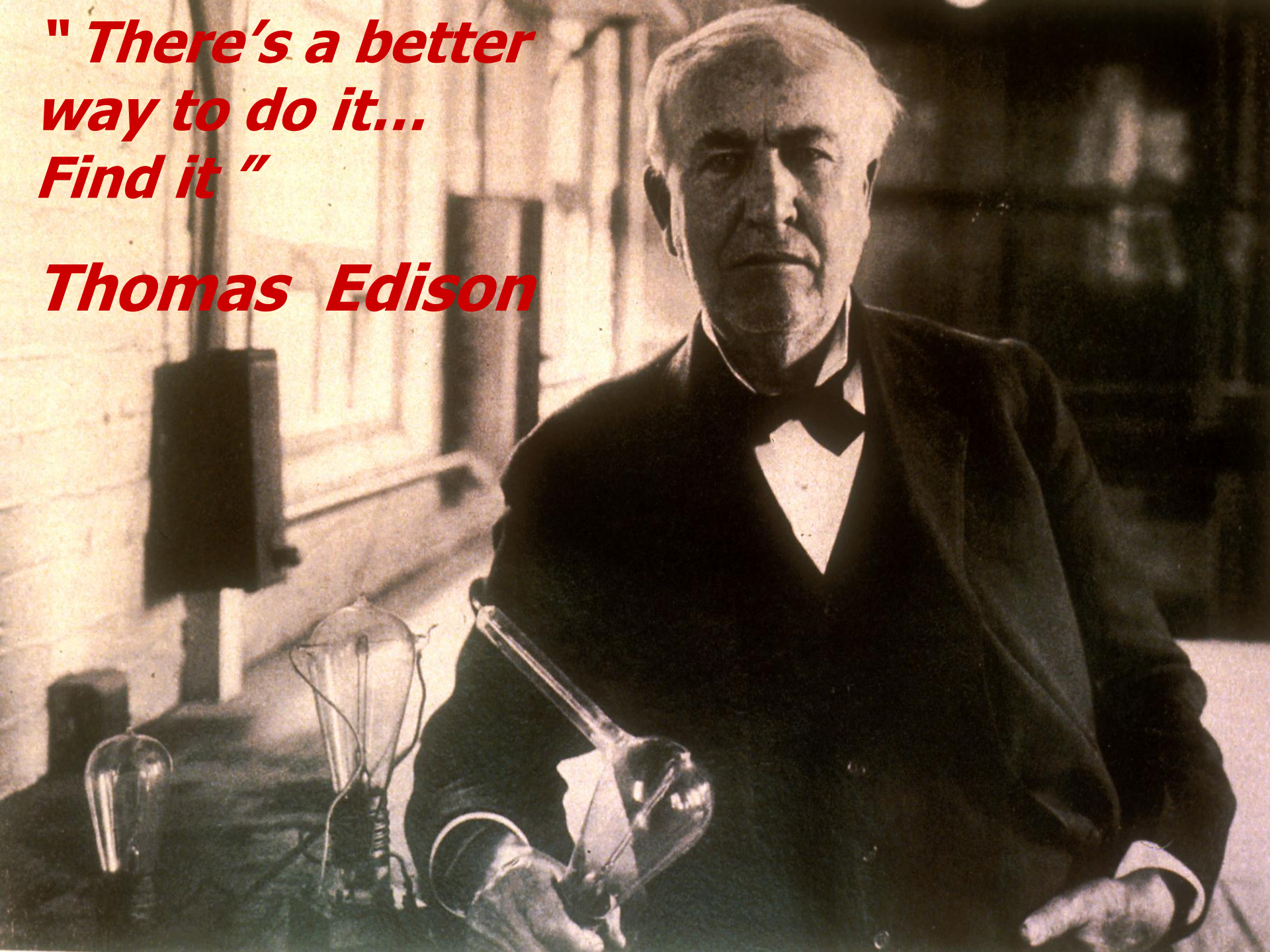
Thin-shell concrete

- Quasi-spherical: strong
- Single-piece monocoque
- Fast on-site build system
- Low CAPEX, OPEX
- Low Earth impact
- Durable, long-life, secure
- Non-combustible shell
- No foundation needed
- Housing, shelter, school ...
- Less material: ~ 2 cm thick
- Super-insulation: UR foam
- C-neutral concrete
- Survives fire, storm,
flood, seismic, war, rot
- Earth-shelterable
- Disaster recover: remote
- Flex configure: shape, size



***" There's a better
way to do it...
Find it "***

Thomas Edison



We have the solution



**We have the solution: rapid, on-site manufacturing system
Scale model prototype in Juneau, Alaska 2010**

1. Alaska Applied Sciences, Inc.
 - 35-year-old startup: Juneau, Alaska
 - C-corp, in good standing, no external debt, private equity
 - No employees
 - No revenue, no product, no cash flow
 - Prototype scale-model success: Now need \$ 600 K to scale-up
 - Bill: BSEE, MBA, Stanford Nancy: Primary teacher; Managing Director *
2. Global need: two deadly problems solved; need a billion buildings --
 - Accelerating Climate Change: Extreme T, storm, fire, flood, sea level rise
 - “Stick-built” obsolete: weak, costly, burns, roof blows off
 - Human protection, survival: housing, all small buildings
3. Novel on-site manufacture process: thin-shell concrete small buildings: housing +
 - Single-piece envelope: strong “monocoque”
 - Low-cost, low-Earth-impact, non-combustible, flex size & shape
4. Scale-model, proof-of-concept prototype success: 2009 – 2025 field test
Ready for \$ 600 K scale-up to human-useful size: validate engrg; find customers
5. B2B: Supply builders forms sets, materials, training, support, QC: sales, franchise
No revenue; no customers; need \$ 600 K to scale-up to sales
6. Price: Forms: \$ 10 K per building. Materials: 2x cost. Train & support: 3x cost.

* 15 years, pro bono, The Leighty Foundation, www.LeightyFoundation.org



Manufacturing system:

- 1 cm (1/2 ") thick concrete
- Proof-of-concept
- Scale model
- Now, scale-up
- Global market: Mitigation + Adaptation, GCC dangers



Robust, insulated shelter -- a prototype for "housing"



**Thin-shell concrete
envelope section**

1 cm (½") thick scale model
2 cm (1") thick full-size

- **Low cost: CAPEX, OPEX**
- **Low Earth impact**
- **Rapid on-site manufacture**
- **Non-combustible**
- **Flexible shape, size**
- **Monocoque: no roof, strong**
- **Minimum import:**
 - **Material**
 - **Tools & equipment**
 - **Expert labor**





Earth-shelterable

- Strong, waterproof, monococque
- Insulation: extreme temps
- Storm protection
- Fire protection
- No roof to blow off
- War zone protection
- Landscaping

**Strength and deflection test: H and V dial indicators inside shell.
1 m sand on top. ~ 0.010" deflection, H and V. Apparently undamaged.**



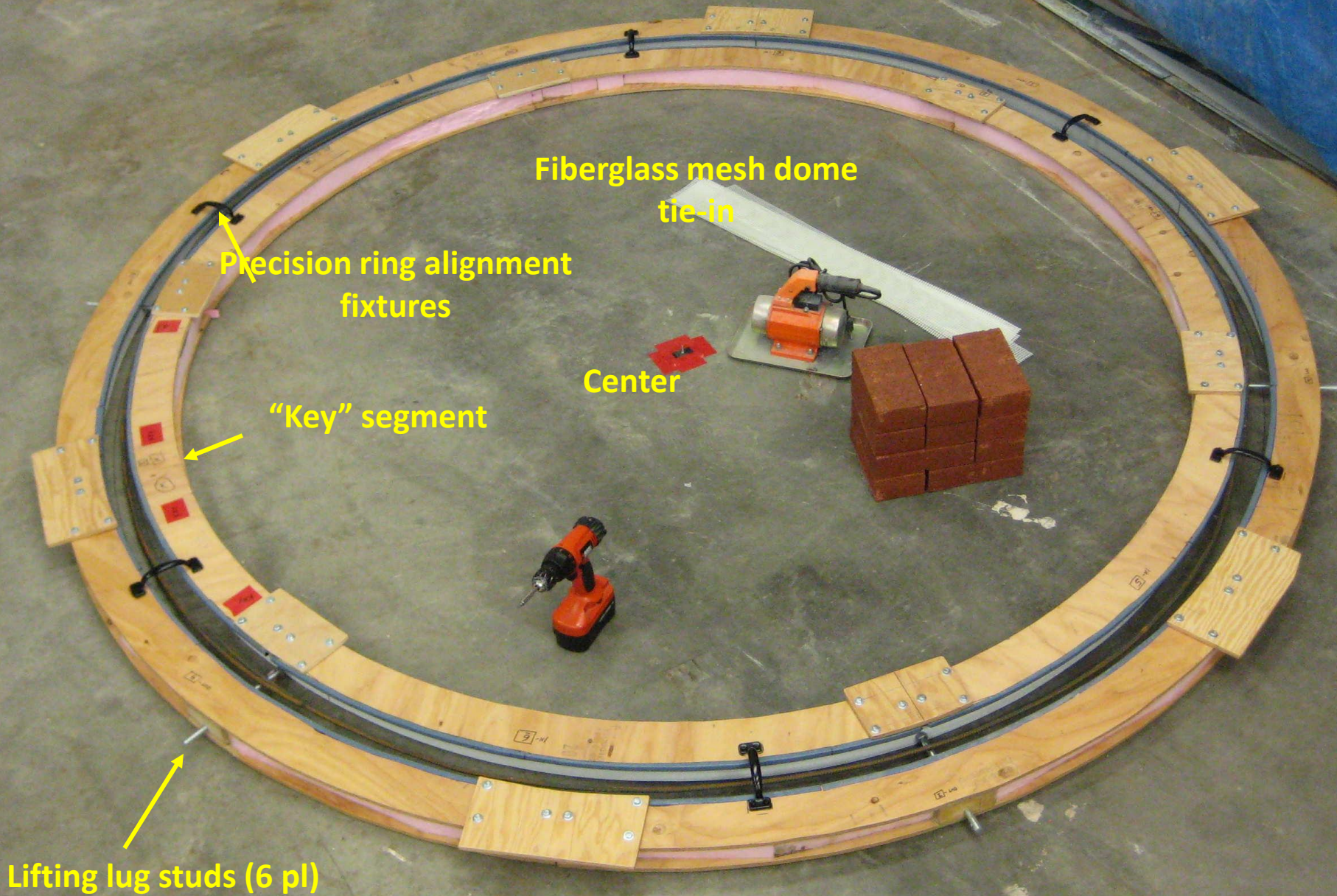
Earth-shelterable

- Insulation: extreme temps
- Storm protection
- Fire protection
- No roof to blow off
- War zone protection
- Landscaping

Earth sheltering from extremes: Weather, storms, war

Great potential, flexibility Earth-sheltering thin-shell concrete small buildings





Fiberglass mesh dome
tie-in

Precision ring alignment
fixtures

Center

"Key" segment

Lifting lug studs (6 pl)

How we built it: Assembled "circus ring" foundation form, ready for pour

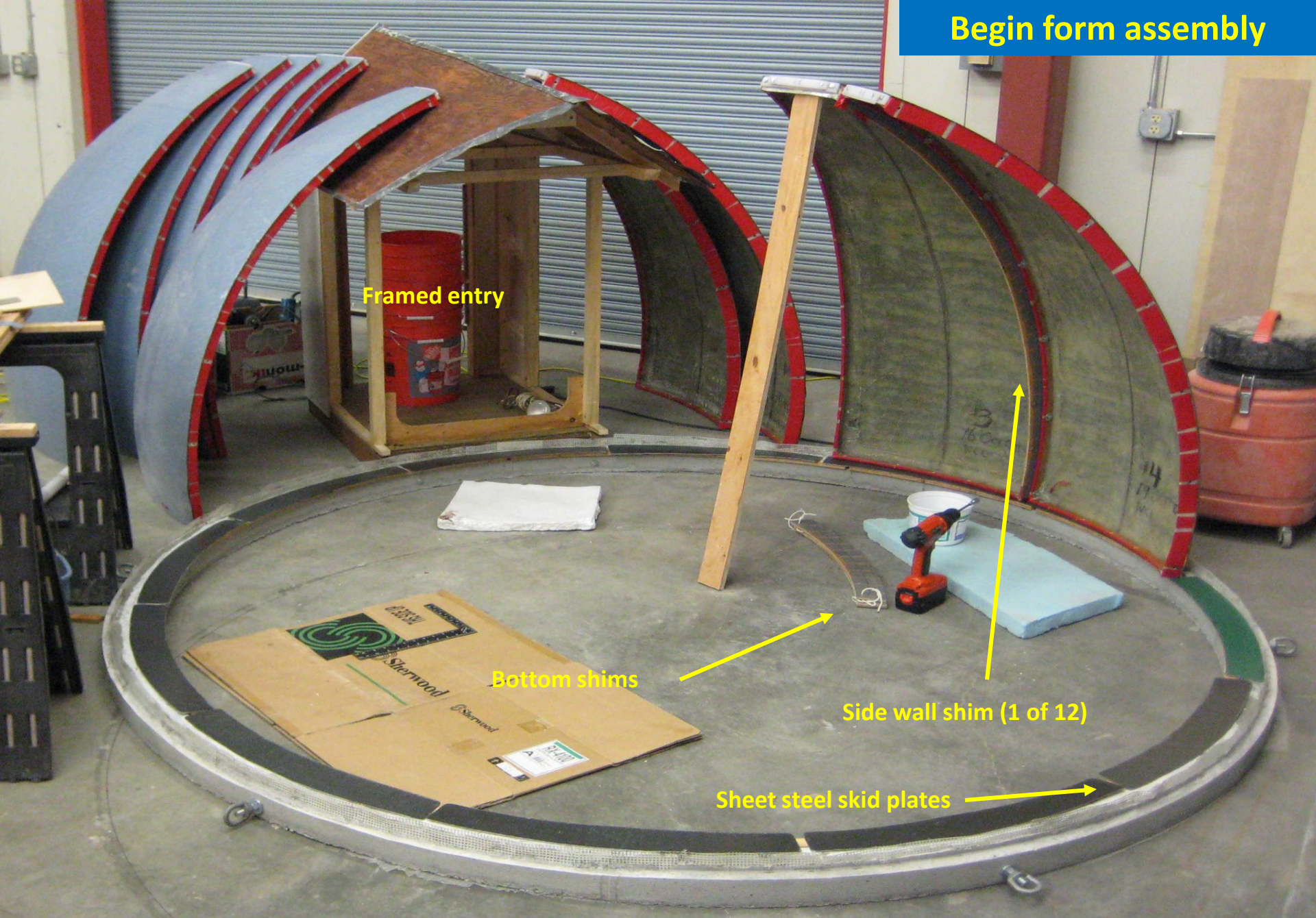
12 form sections ready to assemble on “circus ring” foundation

Framed entry

Top cap

How we built it: Ready to assemble 12 “orange peel” form sections

Begin form assembly



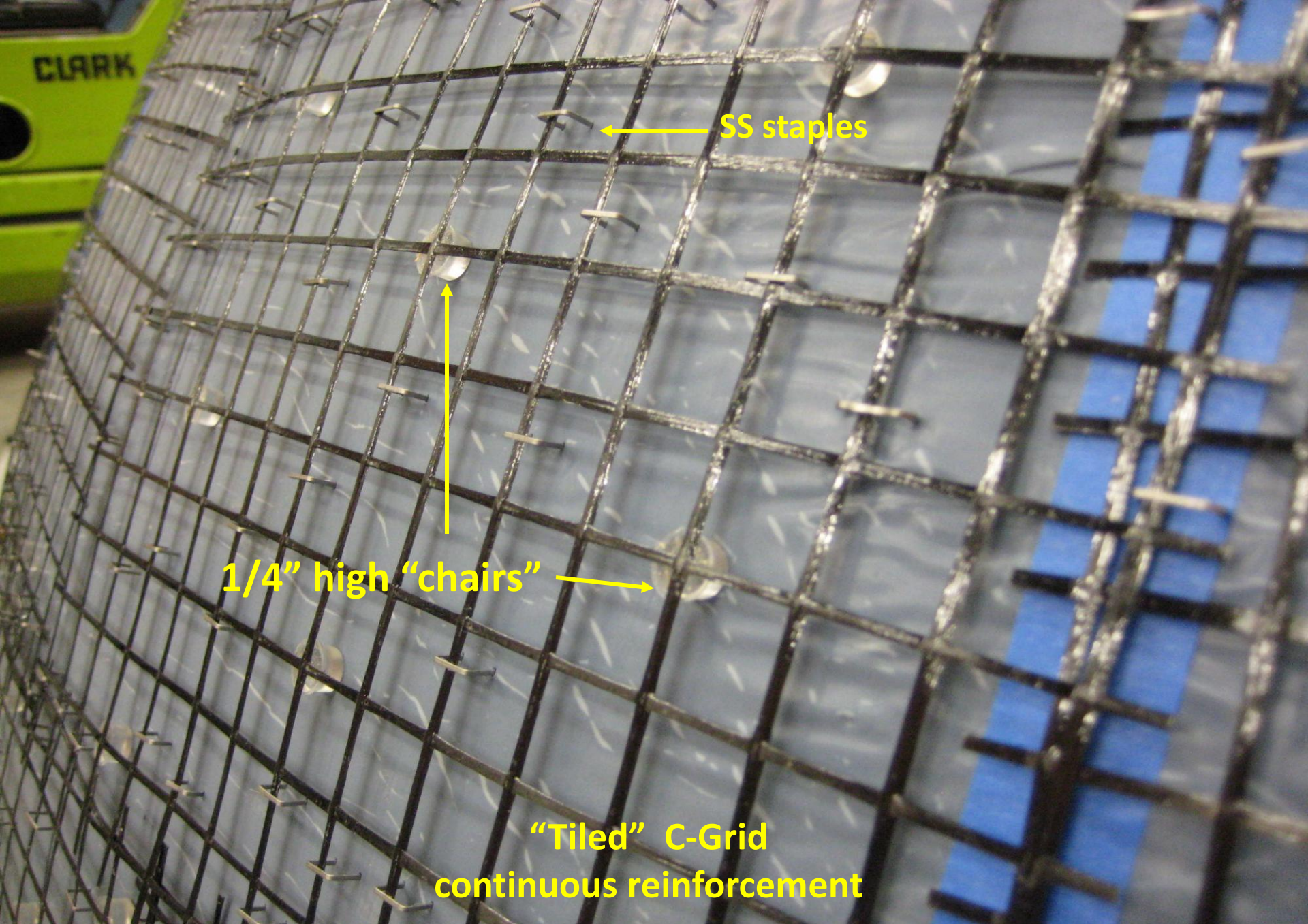
Framed entry

Bottom shims

Side wall shim (1 of 12)

Sheet steel skid plates

How we built it: 12 "orange peel" sections bolt together



SS staples

1/4" high "chairs"

"Tiled" C-Grid
continuous reinforcement

How we built it: primary reinforcement carbon fiber epoxy grid stapled to assembled form

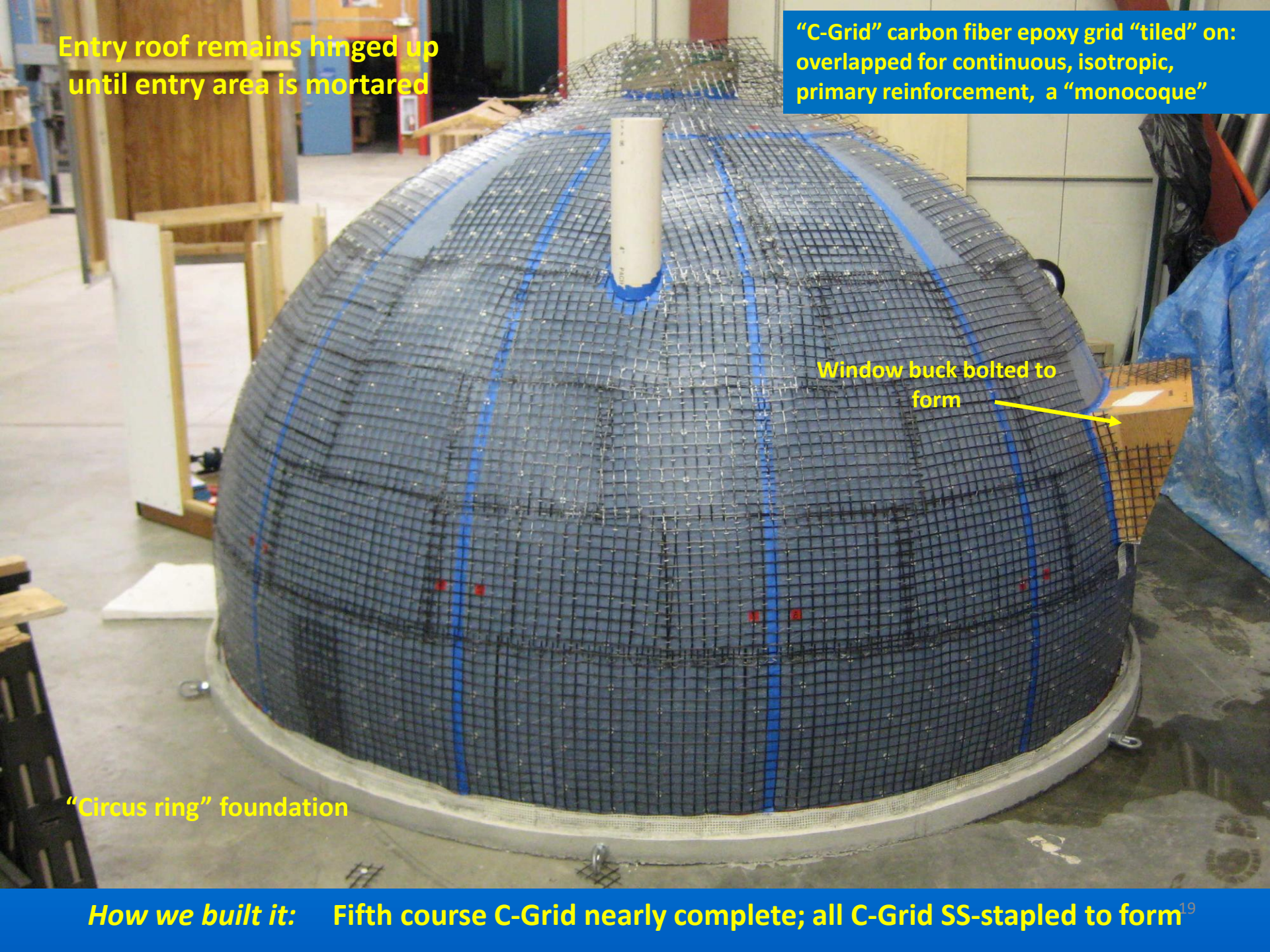
Entry roof remains hinged up until entry area is mortared

"C-Grid" carbon fiber epoxy grid "tiled" on: overlapped for continuous, isotropic, primary reinforcement, a "monocoque"

Window buck bolted to form

"Circus ring" foundation

How we built it: Fifth course C-Grid nearly complete; all C-Grid SS-stapled to form¹⁹





Hinged Entry roof dropped into place

Continuous C-Grid embedded for structural integrity of dome and entry

Removable entry roof form Z-flashing (4 pcs)

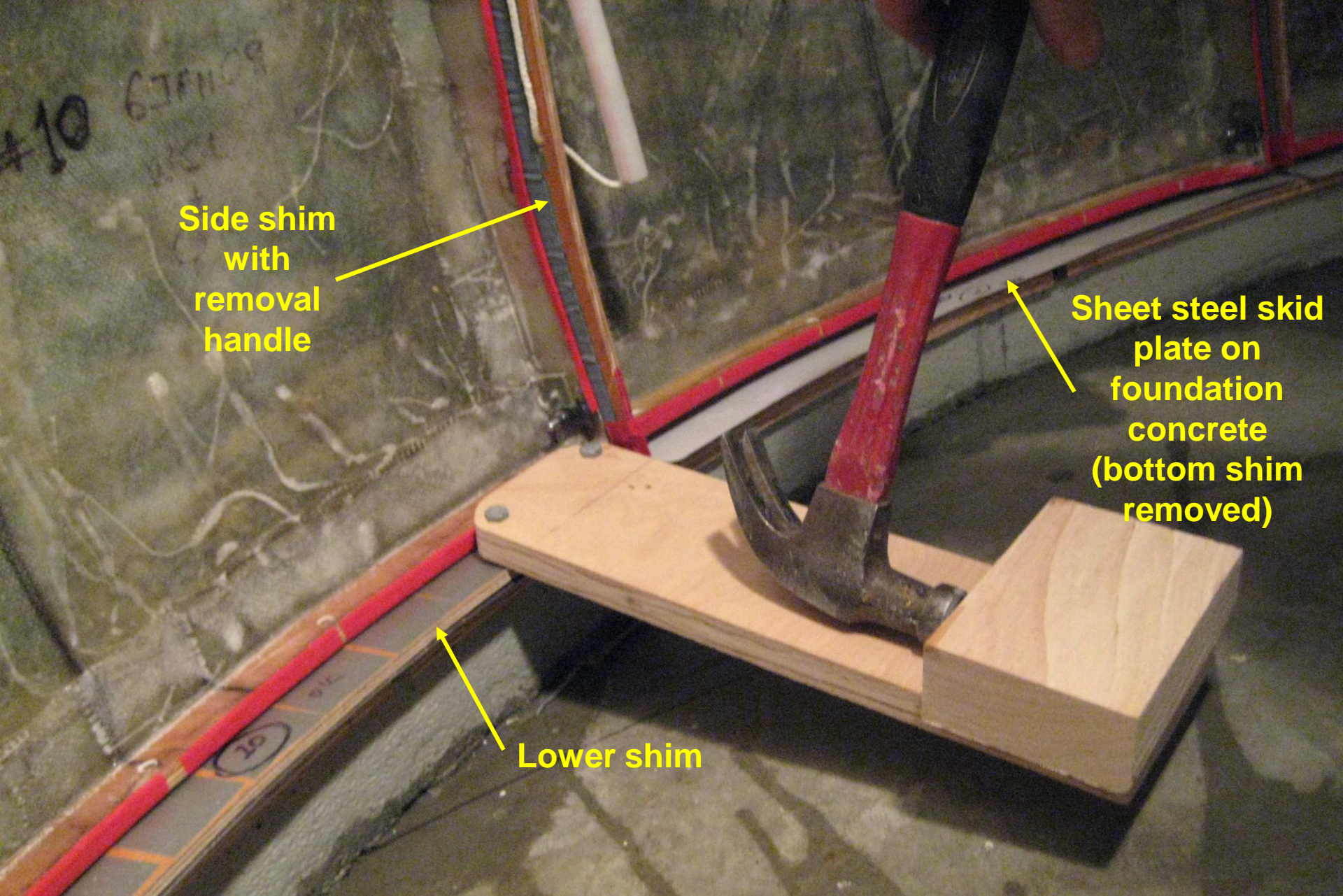
Entry roof hinge

How we built it: applying sand-only-aggregate rich concrete mortar

After dome ~ 80% mortared, hinged entry roof dropped into place for continuous concrete structural continuity



How we built it: applying sand-only-aggregate rich concrete mortar

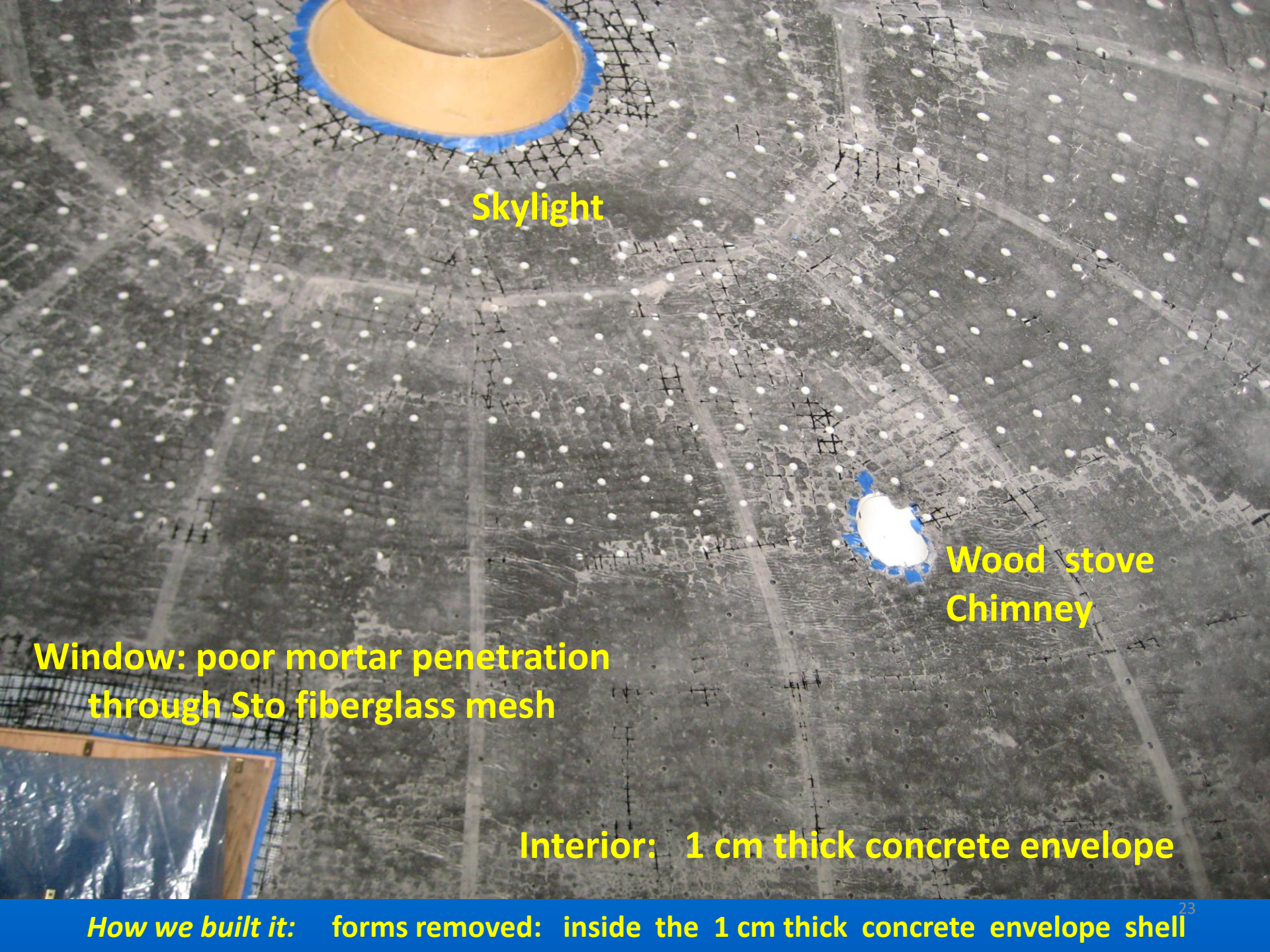


Side shim
with
removal
handle

Sheet steel skid
plate on
foundation
concrete
(bottom shim
removed)

Lower shim

How we built it: after 30 hour cure, removing forms set



Skylight

**Wood stove
Chimney**

**Window: poor mortar penetration
through Sto fiberglass mesh**

Interior: 1 cm thick concrete envelope

How we built it: forms removed: inside the 1 cm thick concrete envelope shell



Skylight

Scaled plumbing vent

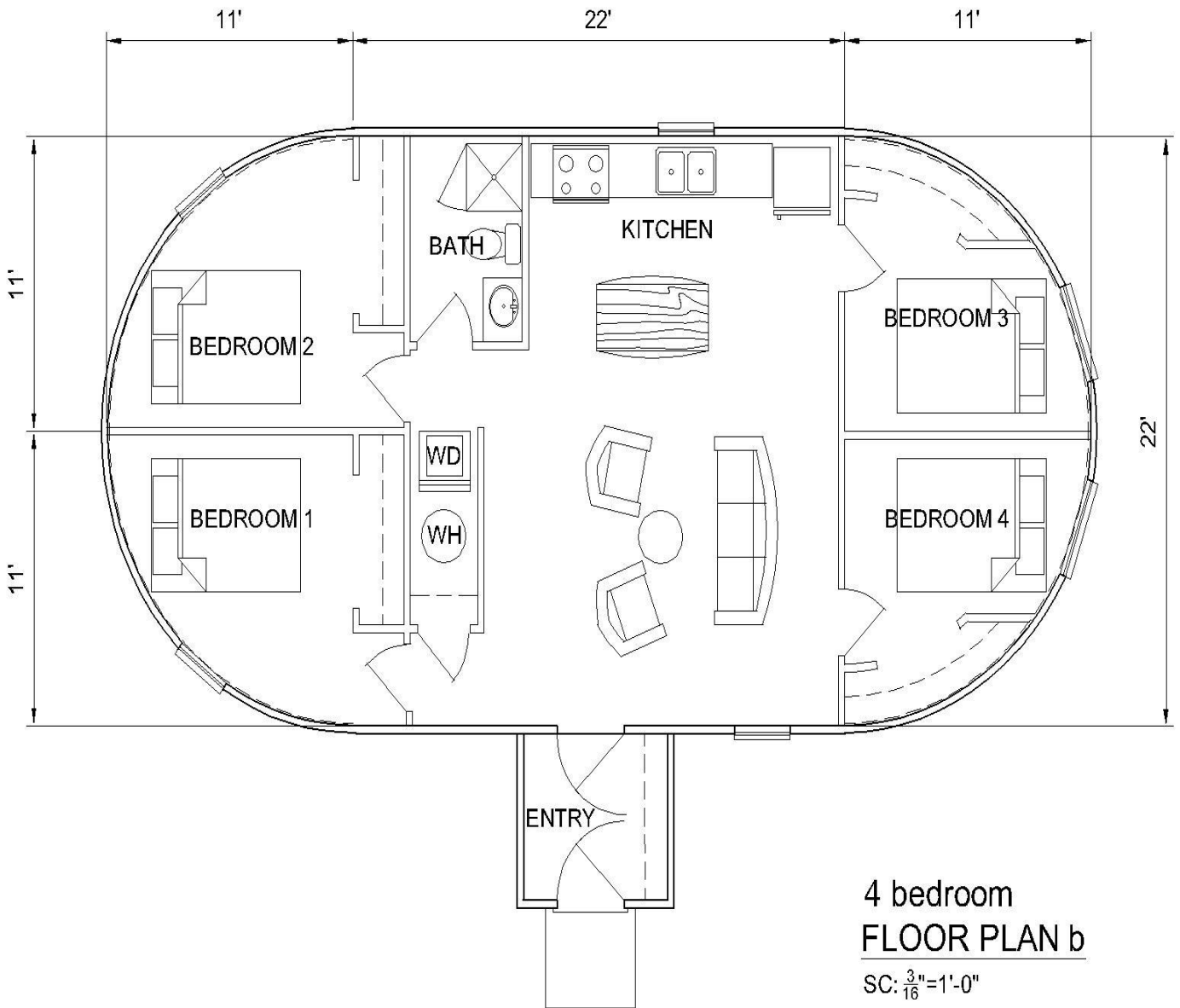
Scaled
woodstove
chimney



***How we built it:* 2 cm thick UR foam insulation + plaster sprayed on interior**

12 volt LED lighting + USB charging

Sleeps three: shelter, not “housing” Ready to scale-up for “model homes”



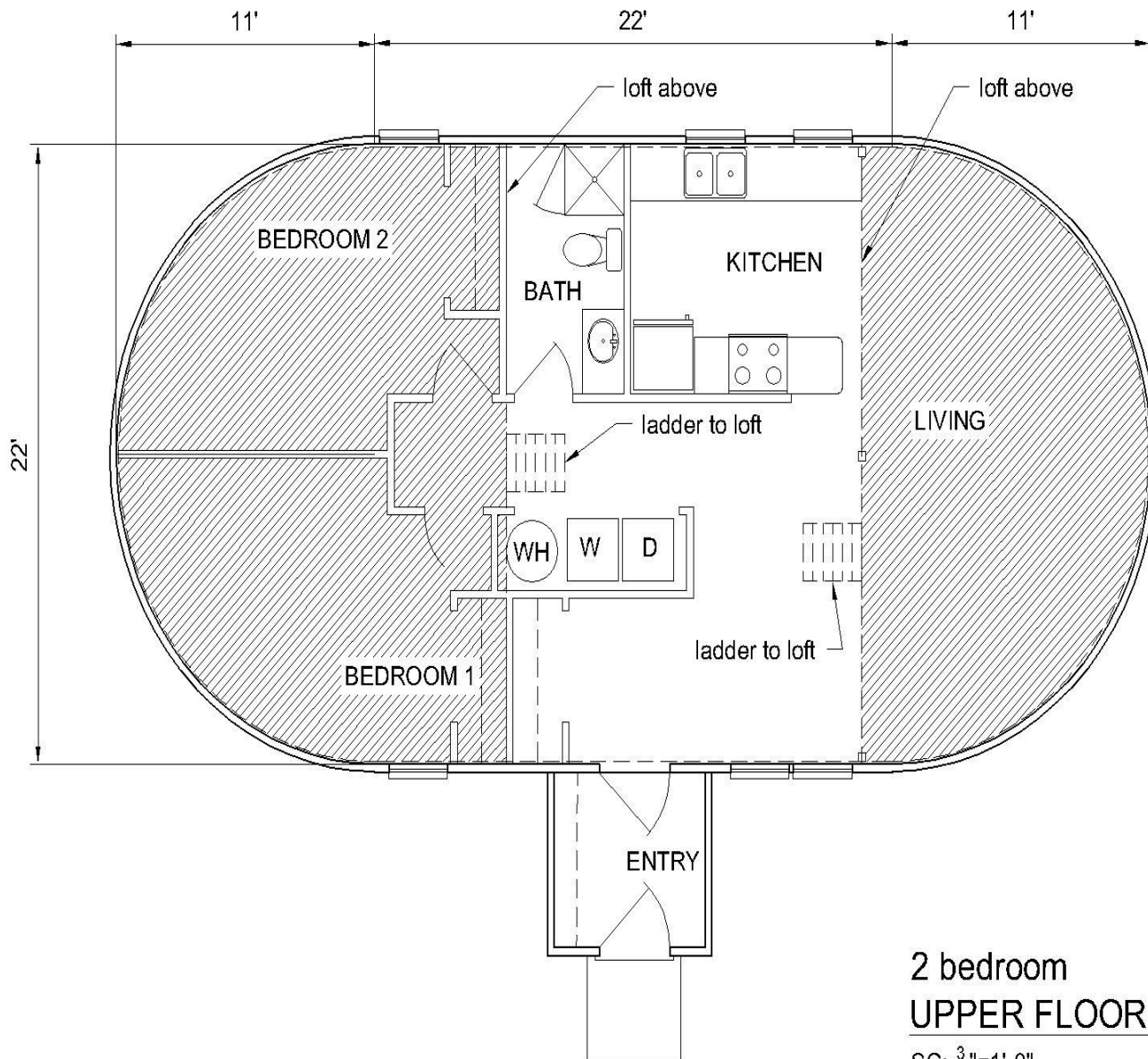
4 bedroom
FLOOR PLAN b

SC: $\frac{3}{16}$ "=1'-0"

Model Home

**Floor Plan Option
 4 bedroom, 1 bath**

Two half-lofts not shown



2 bedroom
 UPPER FLOOR PLAN

SC: $\frac{3}{16}'' = 1'-0''$

Model Home

Two Half-lofts Above main floor

Sleeping plus storage

Access via ladders:
 Fixed or retractable

See Cross Section:
 About 4 ft
 head room at loft center

Inevitable:

- GCC emergency
- Engineering optimum
- Physics correct

**Quasi-spherical thin-shell concrete
Monococque (single piece)**

Global climate change (GCC) protection:

- Extreme temps
- Storm
- Fire
- Flood, earthslide





\$ 600 K to scale-up to human-useful size:

- Morph to “sausage house” from “dome”
- \$ 350 K new tools + 2 forms sets
- \$ 50 K engineering
- \$ 200 K model home: customer demand ?

**Two urgent global problems
profitably solved:
Scale model, proof-of-concept**

Refurbished: August 2023

Thin-shell Concrete Quasi-spherical Small Buildings: Durable, Low-cost, Low-Earth impact, Global Shelter

Now \$ 600 K scale-up
to human-useful size

We have solution

Bill Leighty, Principal
Alaska Applied Sciences, Inc.
Juneau, Alaska
wleighty@earthlink.net
Rev: 22 April 26

Juneau, AK 1974: 16' diameter concrete dome: 1/2" thick, ~ 5/8 sphere

1. Alaska Applied Sciences, Inc.
 - 35-year-old startup: Juneau, Alaska
 - C-corp, in good standing, no external debt, private equity
 - No employees
 - No revenue, no product, no customers, no cash flow
 - Prototype scale-model success: Now need \$ 600 K to scale-up
 - Bill: BSEE, MBA, Stanford Nancy: Primary teacher; Managing Director *
2. Global need: two deadly problems solved; need a billion buildings --
 - Accelerating Climate Change: Extreme T, storm, fire, flood, sea level rise
 - “Stick-built” obsolete: weak, costly, burns, roof blows off
 - Human protection, survival: housing, all small buildings
3. Novel on-site manufacture process: thin-shell concrete small buildings: housing +
 - Single-piece envelope: strong “monocoque”
 - Low-cost, low-Earth-impact, non-combustible, flex size & shape
4. Scale-model, proof-of-concept prototype success: 2009 – 2025 field test
Ready for \$ 600 K scale-up to human-useful size: validate engrg; find customers
5. B2B: Supply builders forms sets, materials, training, support, QC: sales, franchise
Need \$ 600 K to scale-up to sales
6. Prices: Forms use: \$ 10 K per building. Materials: 2x cost. Train & support: 3x cost

* 15 years, pro bono, The Leighty Foundation, www.LeightyFoundation.org