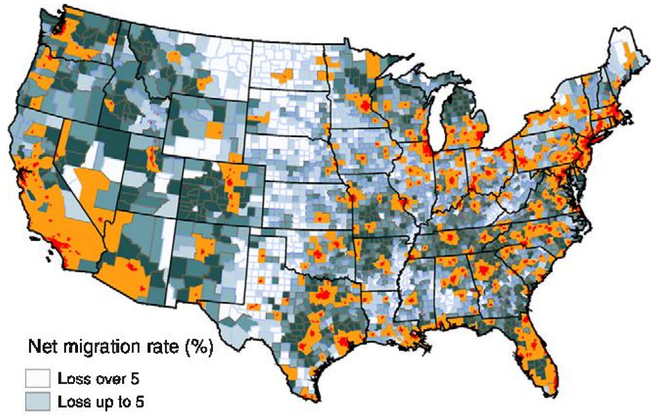

WINDSWEPT SADDLE



Net migration rate (%)

- Loss over 5
- Loss up to 5
- Gain up to 5
- Gain 5 to 10
- Gain 10 to 15
- Gain over 15

Urban

- Urban (metropolitan) county
- Urbanized area


RANCH. CONSERVE. LIVE.


Ranchlands


ultra boost


1907


OSPREY
ATMOS AG 50

?

English riding saddle tree

Western saddle tree

40.1 pounds

Surface vessels dilate

2x sweat rate / inch^2

Can loose 4 gallons / hr

Higher electrolytes in sweat
make it harder to detect thirst

2% drop in body water leads
to 10% drop in performance

Sweat = saddle sores

Horses can’t work until they heal


Wilson Ranch

Problems to address:

1. **Saddle horn needs to have excellent rope grip**
2. **Saddles are heavy to carry for horses and riders**
3. **Horses and riders struggle to keep cool**
4. **Friction from sweat under pads leads to saddle sores**

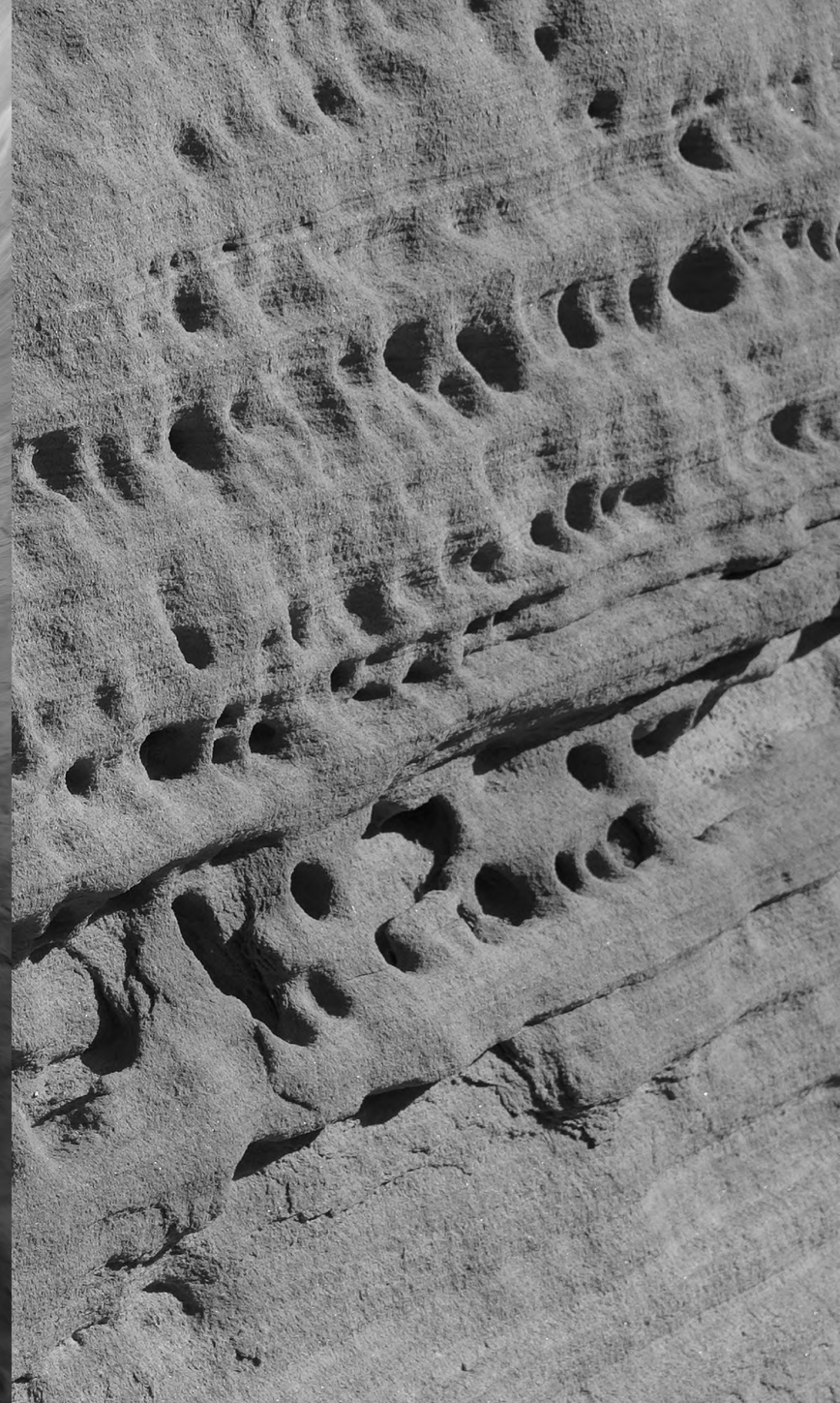
Metrics for success

1. **Horn has equal grip to existing horns without needing wraps**
2. **Saddle weighs half of current saddles**
3. **Airflow is directed through the saddle with better overall breathability**
4. **Padding system allows next-to-skin breathability**

auto-locking buckle

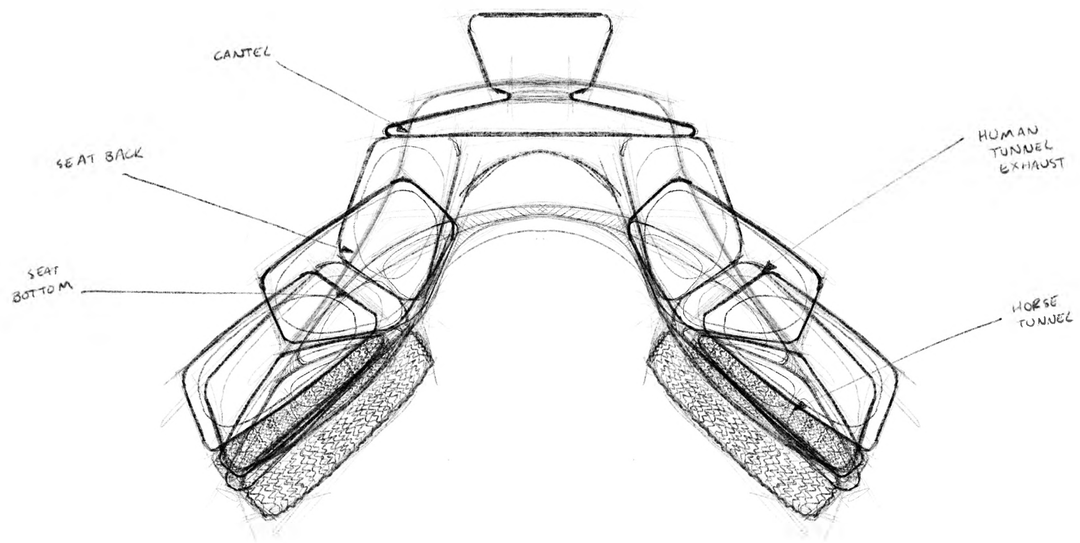
Topology optimized structure

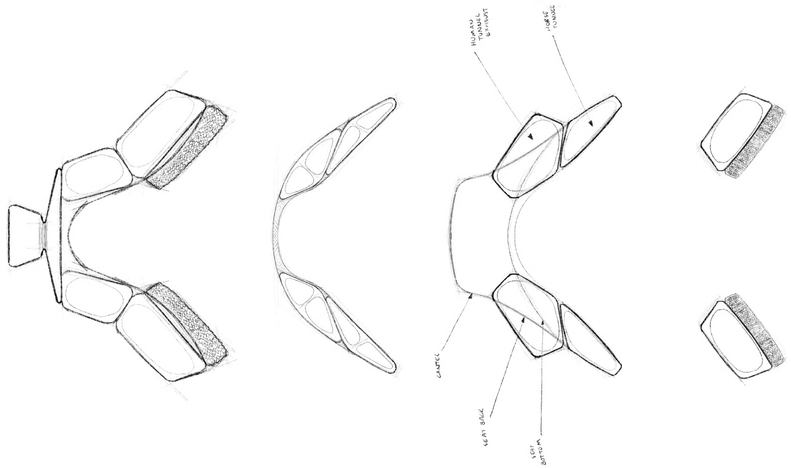


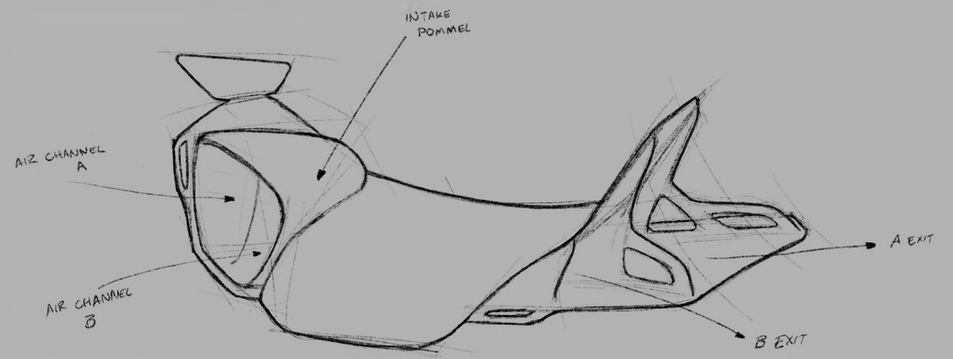


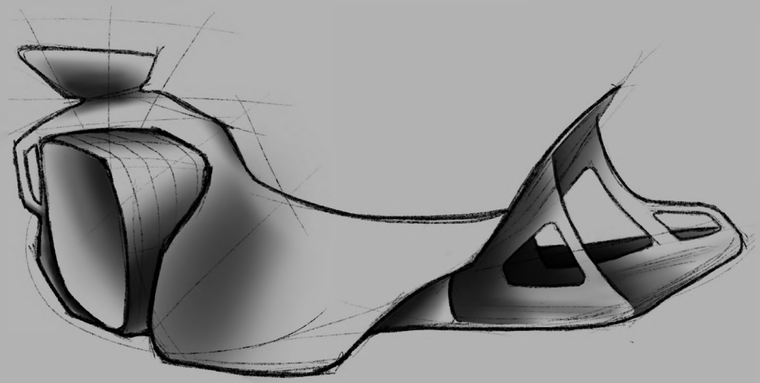
EL CAMINO

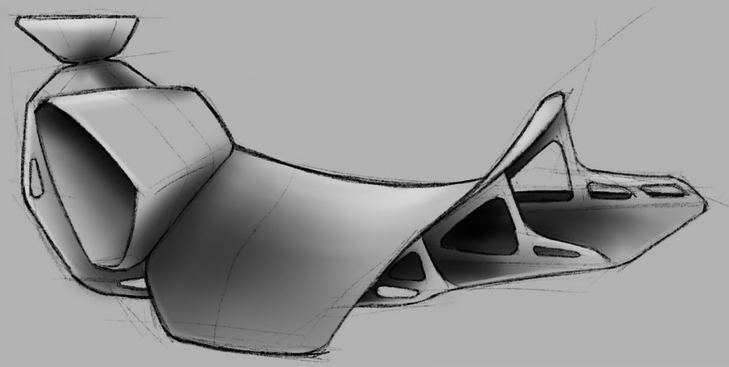
Domus (font selections)

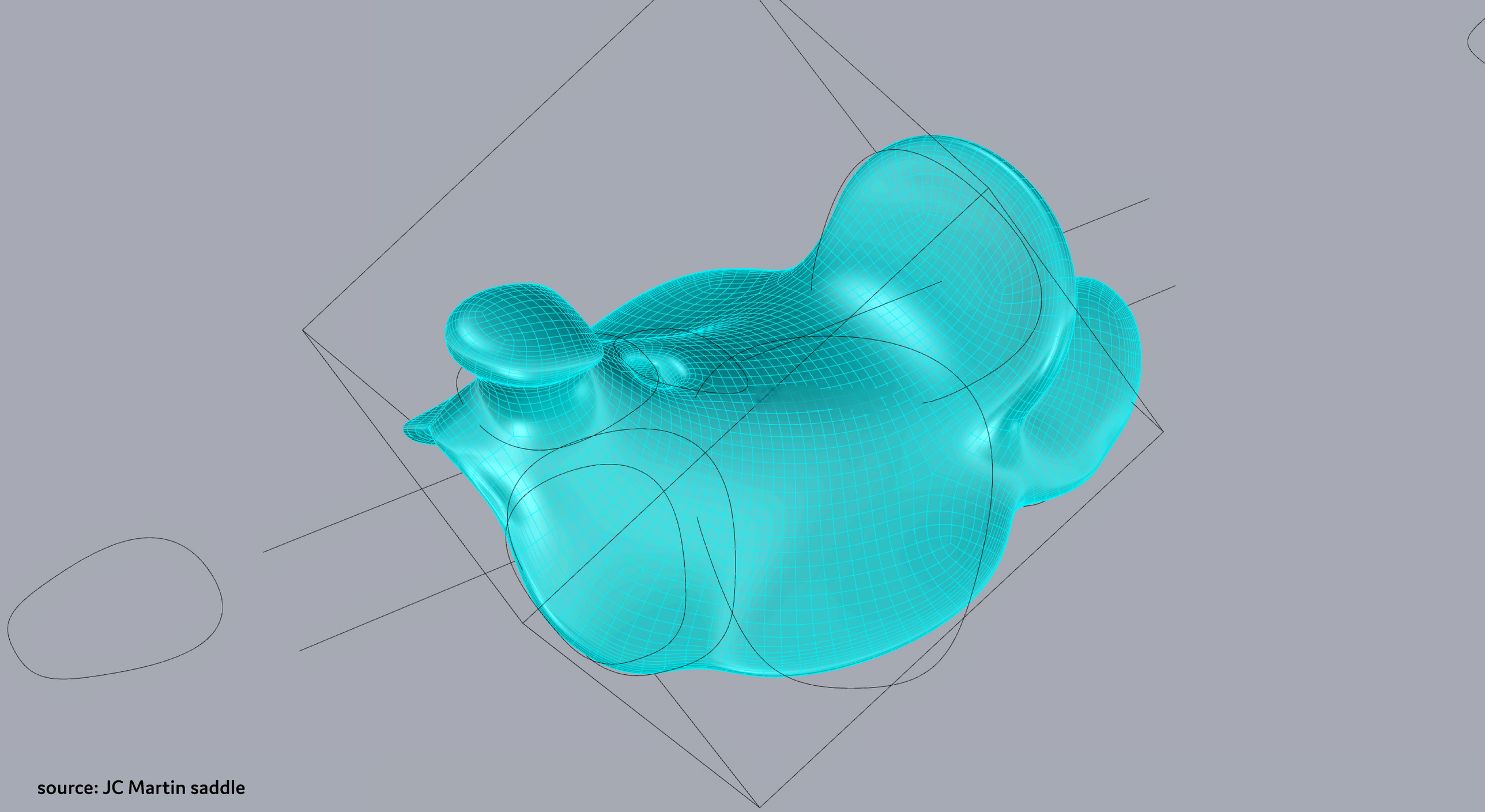

CANTEL
SEAT BACK
SEAT BOTTOM
HUMAN TUNNEL EXHAUST
HORSE TUNNEL



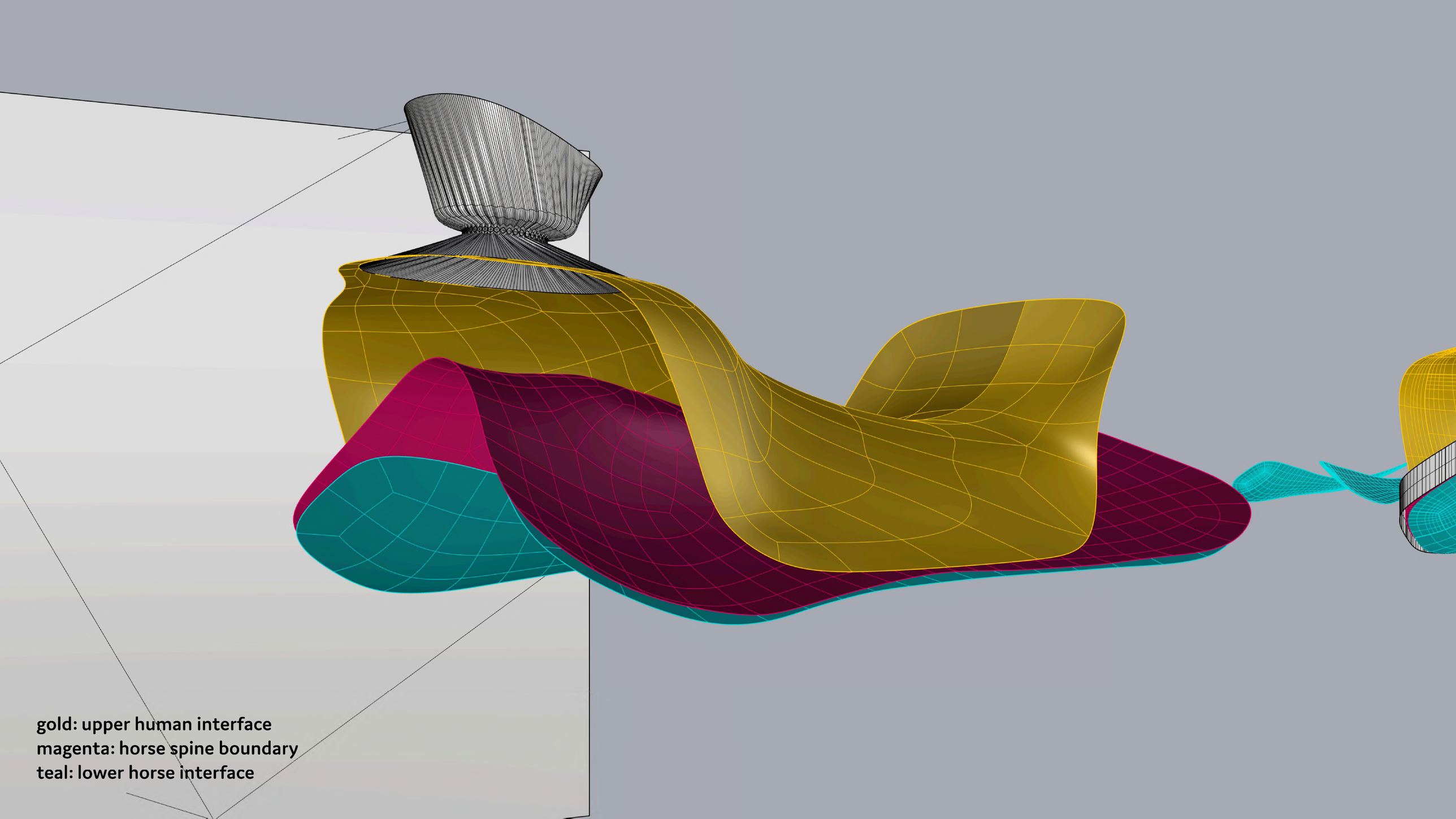

INTAKE POMMEL
AIR CHANNEL A
AIR CHANNEL B
A EXIT
B EXIT

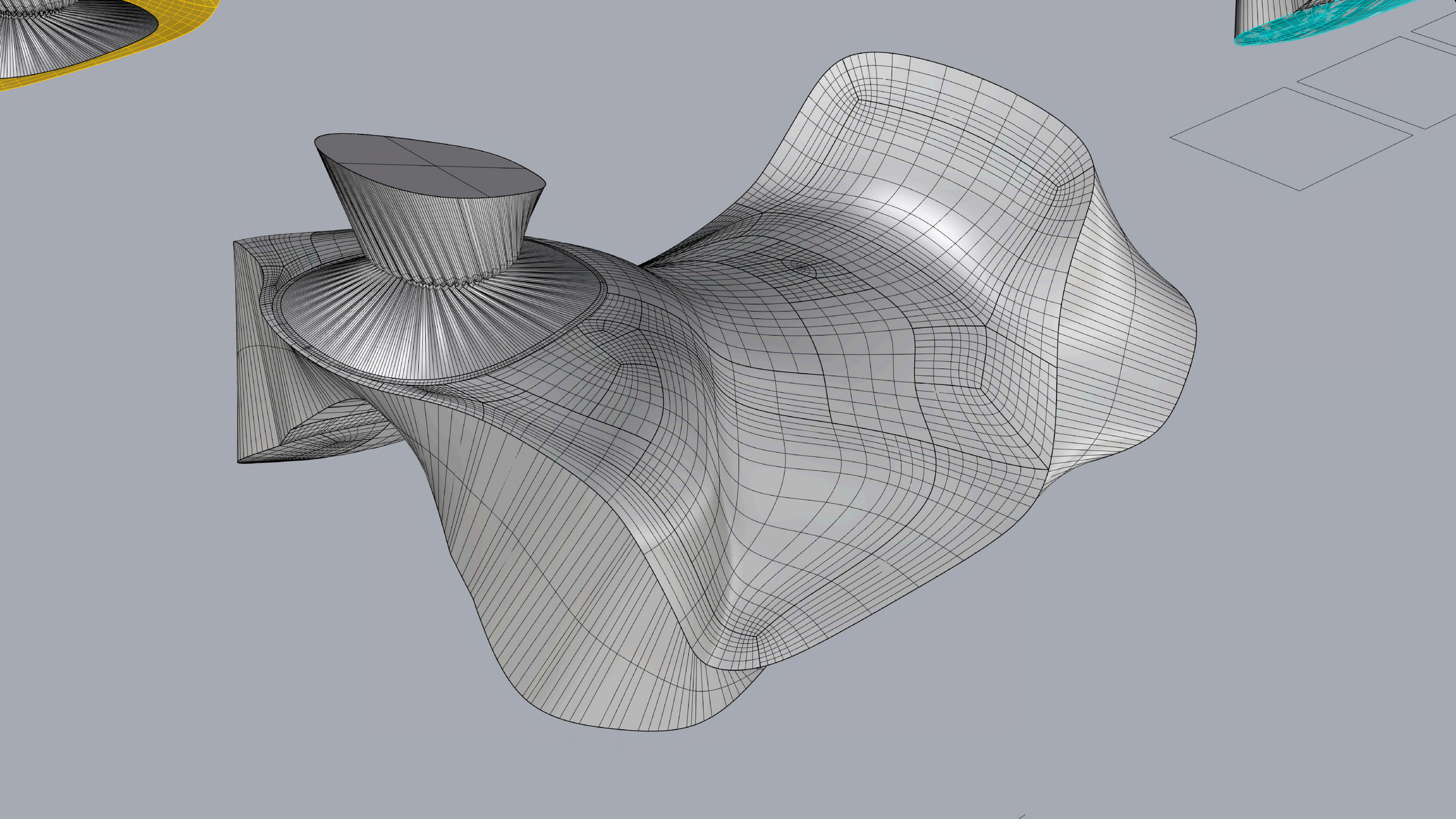


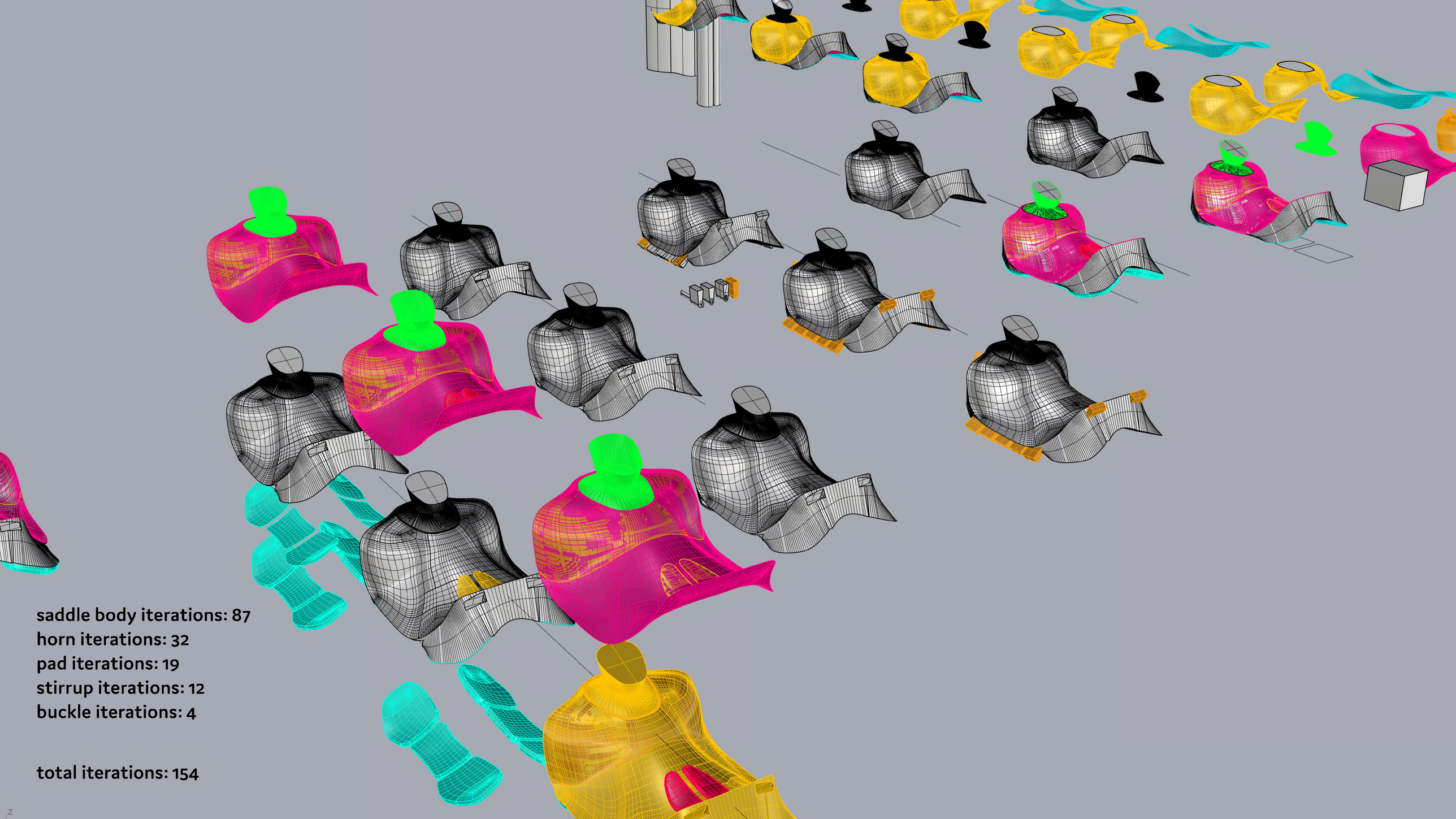


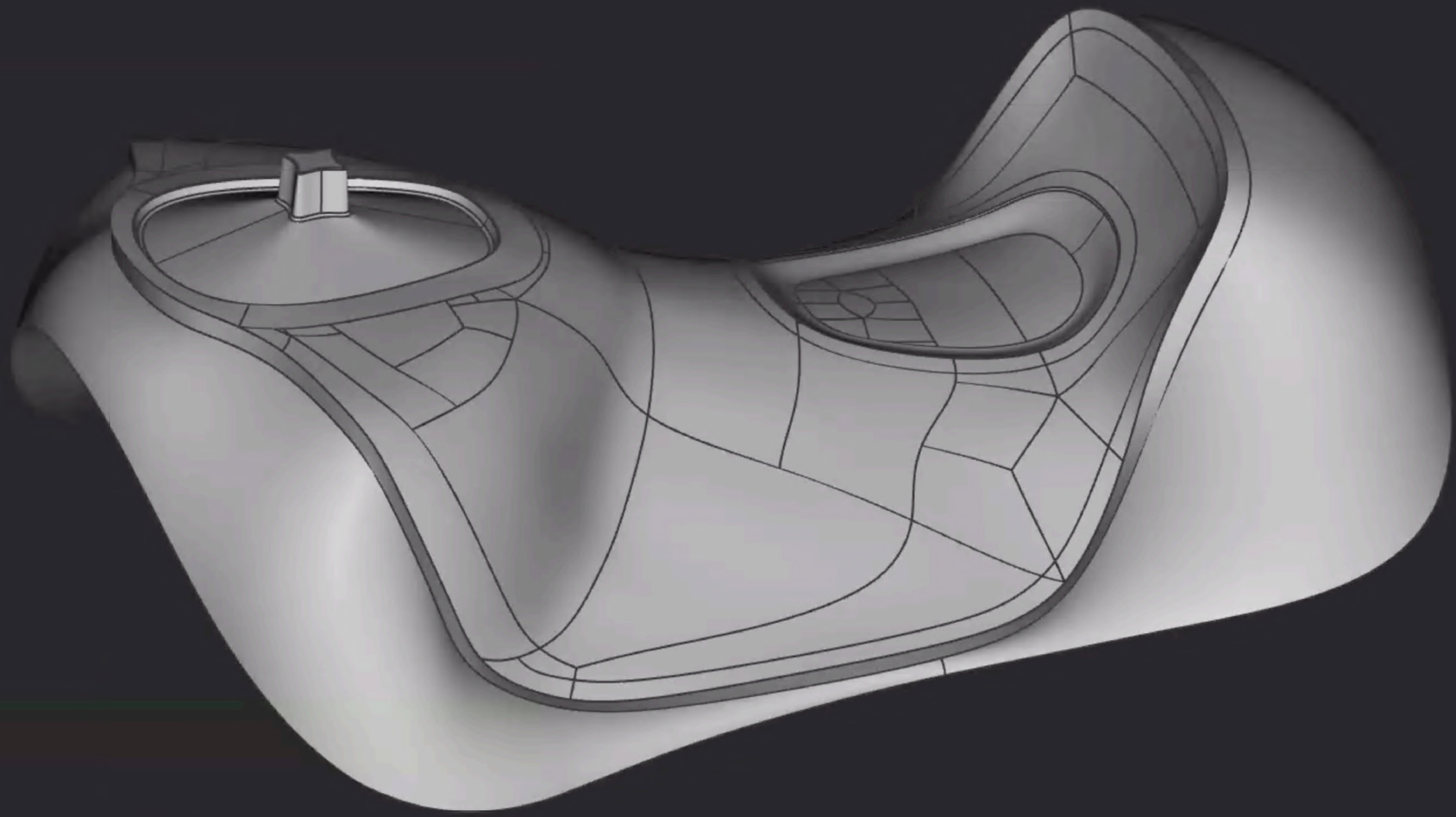


source: JC Martin saddle


gold: upper human interface
magenta: horse spine boundary
teal: lower horse interface

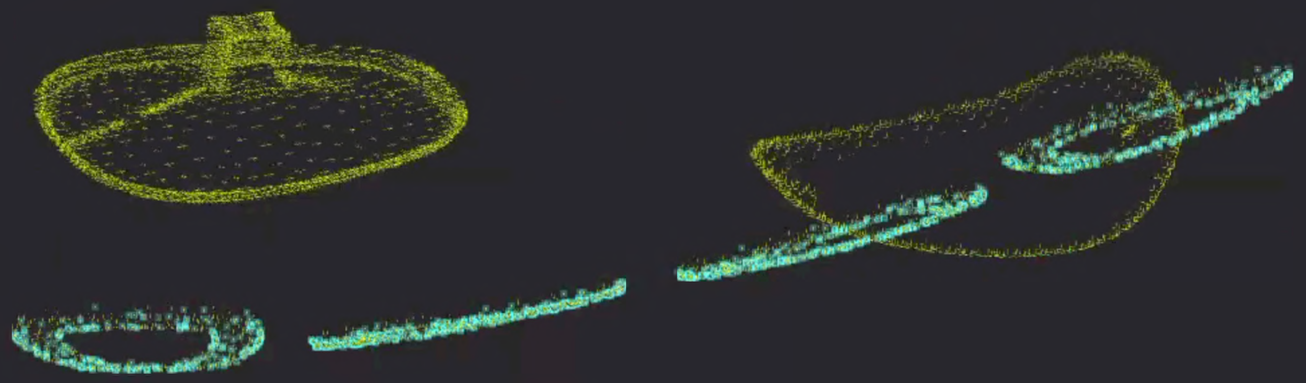



saddle body iterations: 87
horn iterations: 32
pad iterations: 19
stirrup iterations: 12
buckle iterations: 4
total iterations: 154



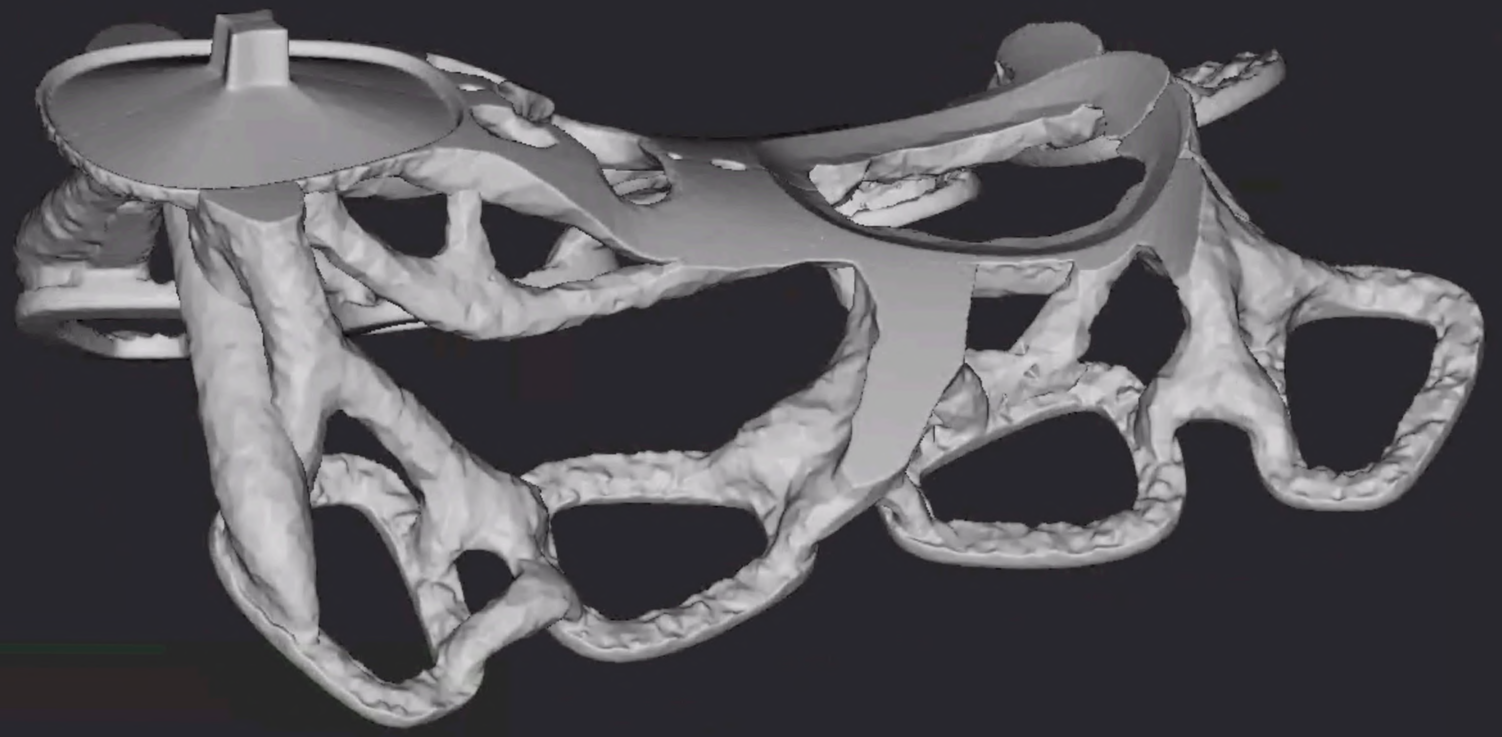
build volumes: 1
interface surface regions: 14

build volume iteration: 4



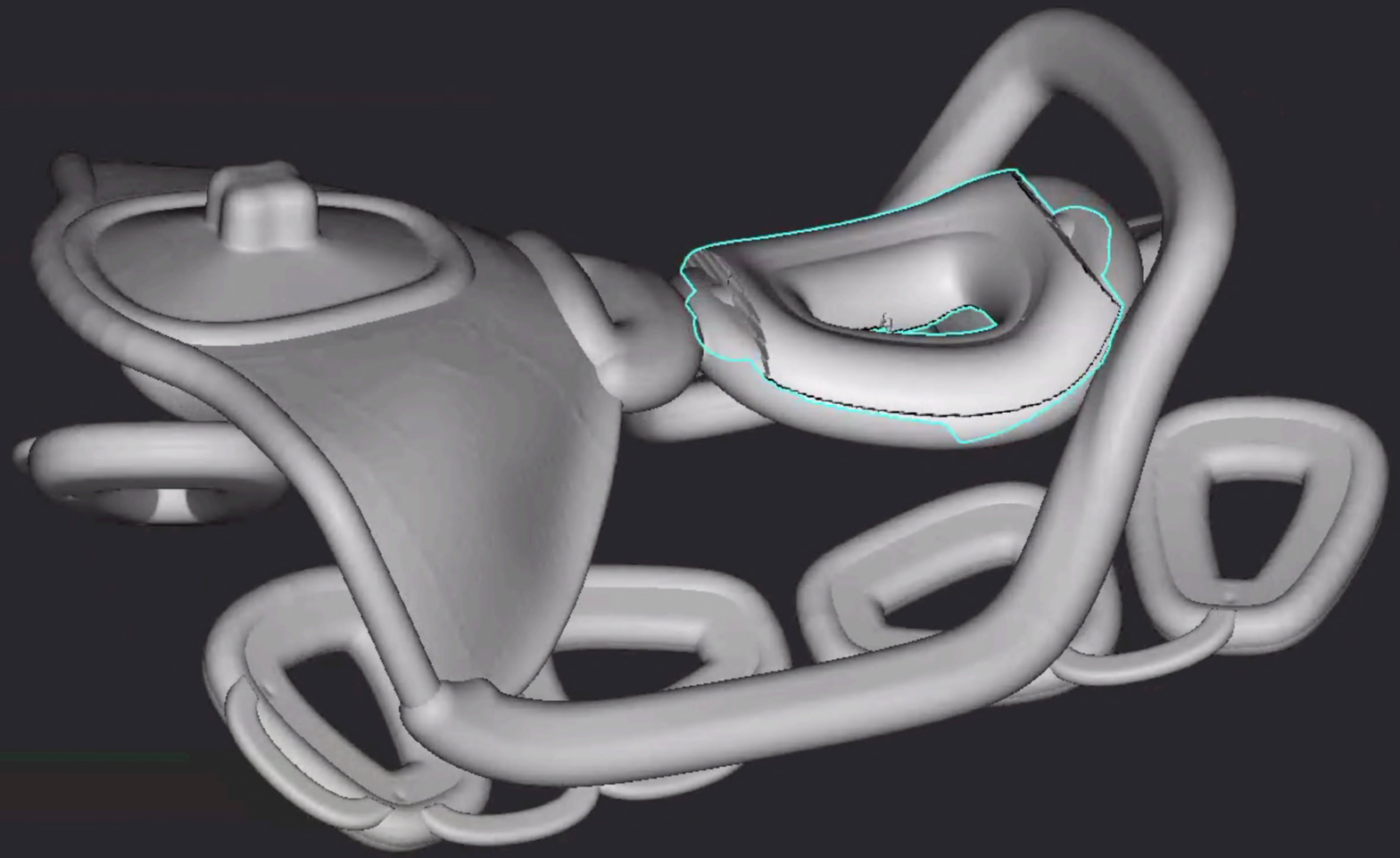
horn force vectors: 4
seat force vectors: 3
pad force vectors: 3 (mirrored)
total force vectors: 13

force vector iteration: 27

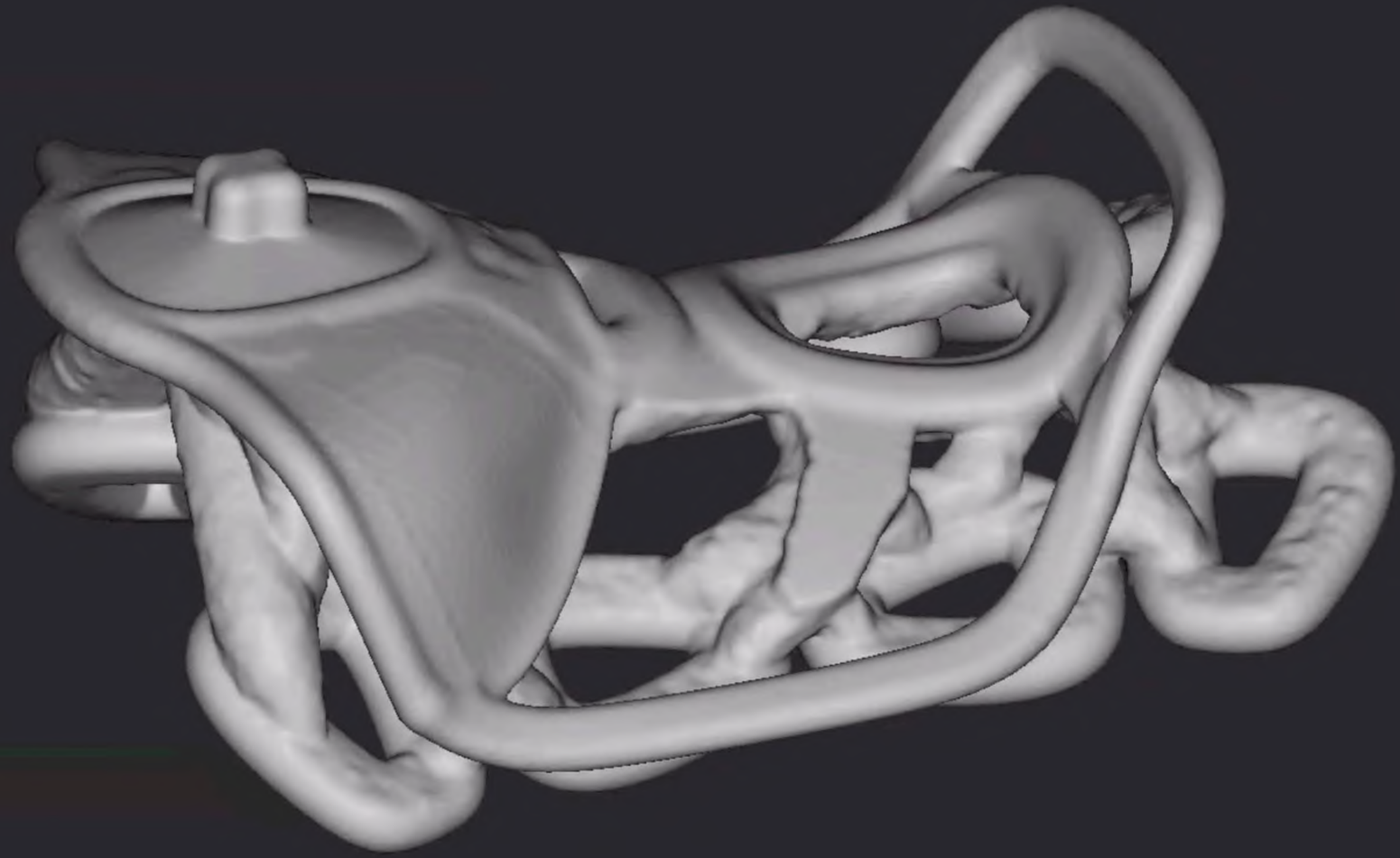


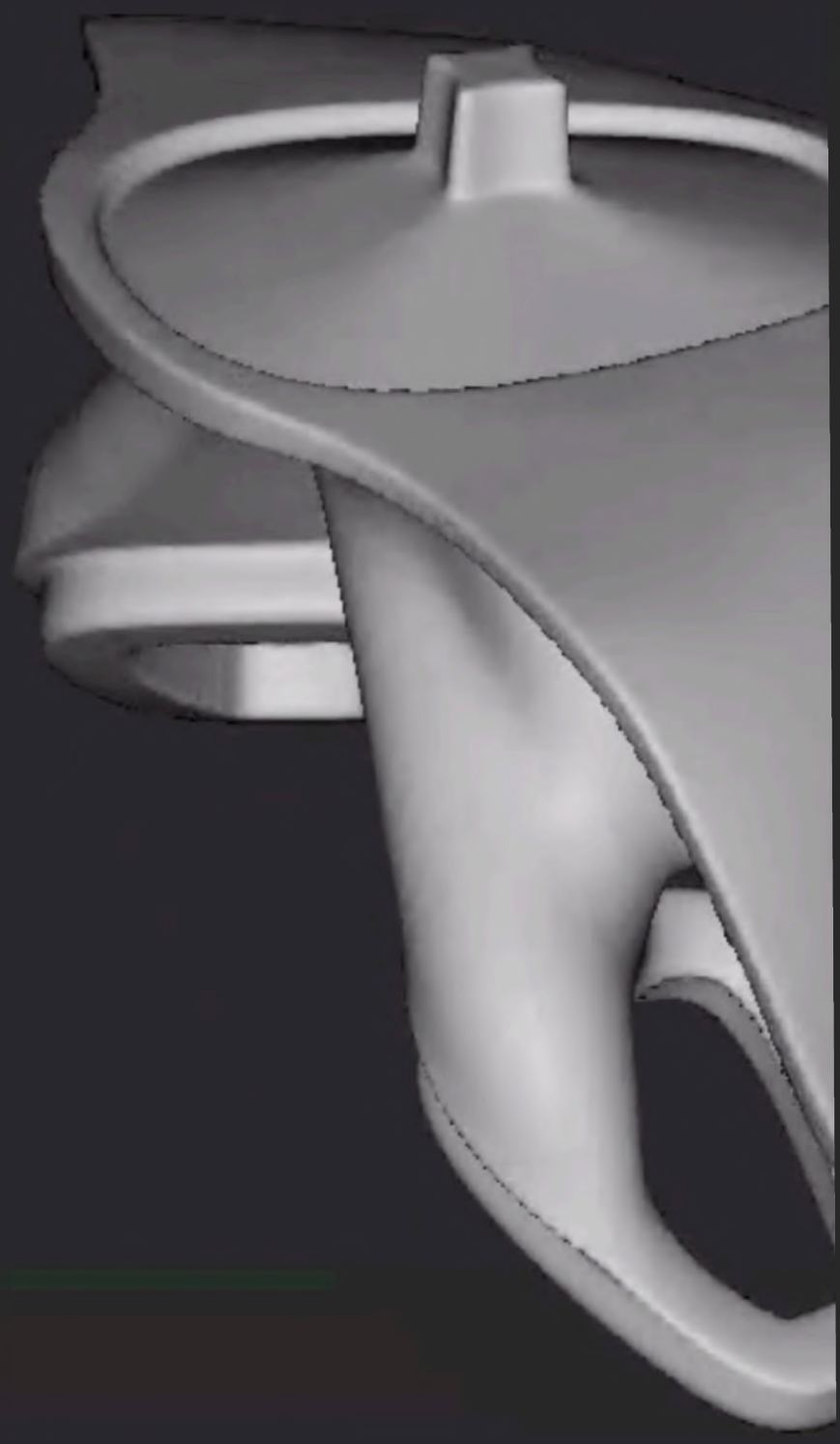
topology optimization regions: 4

top opt iteration: 51

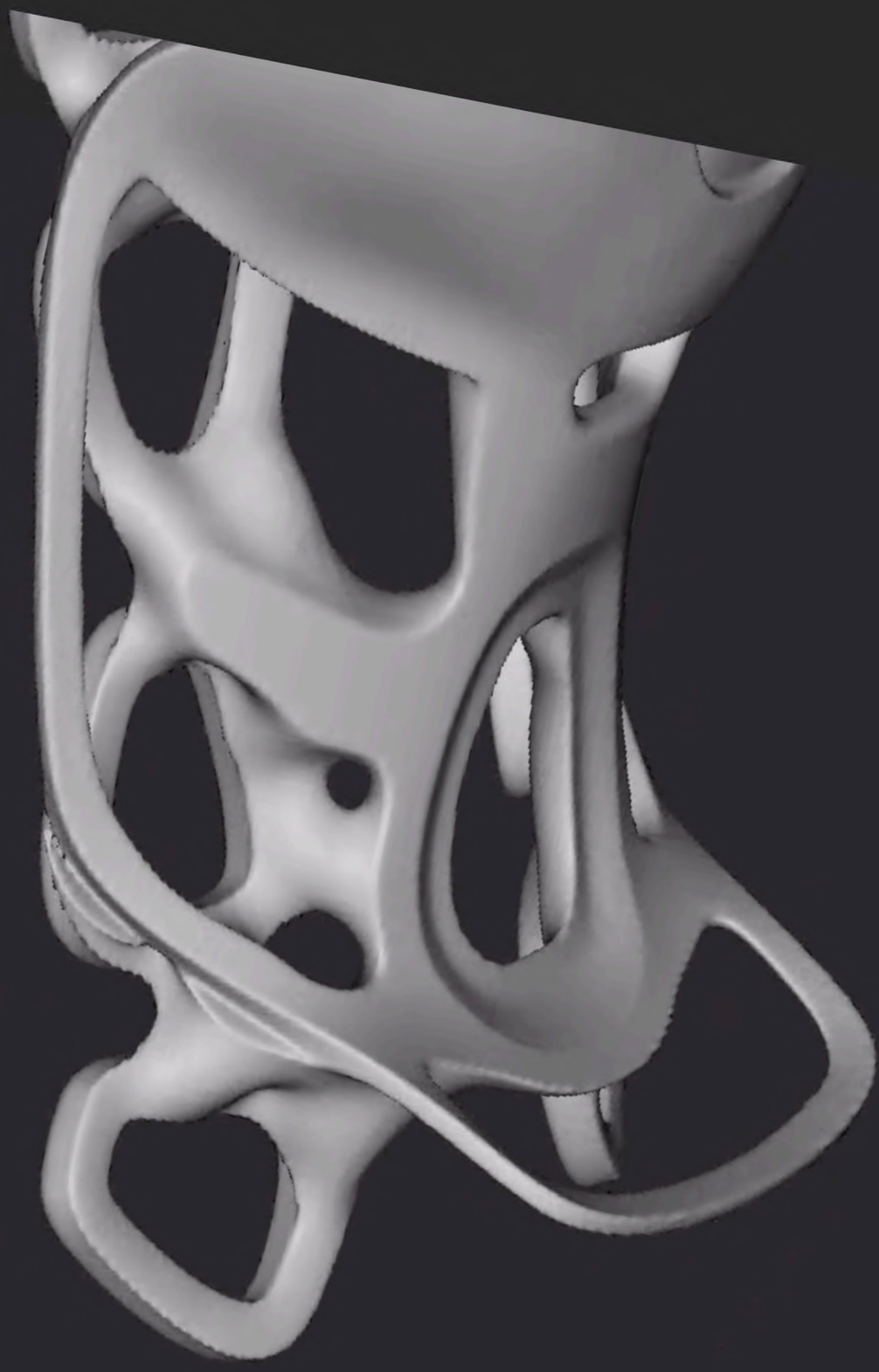


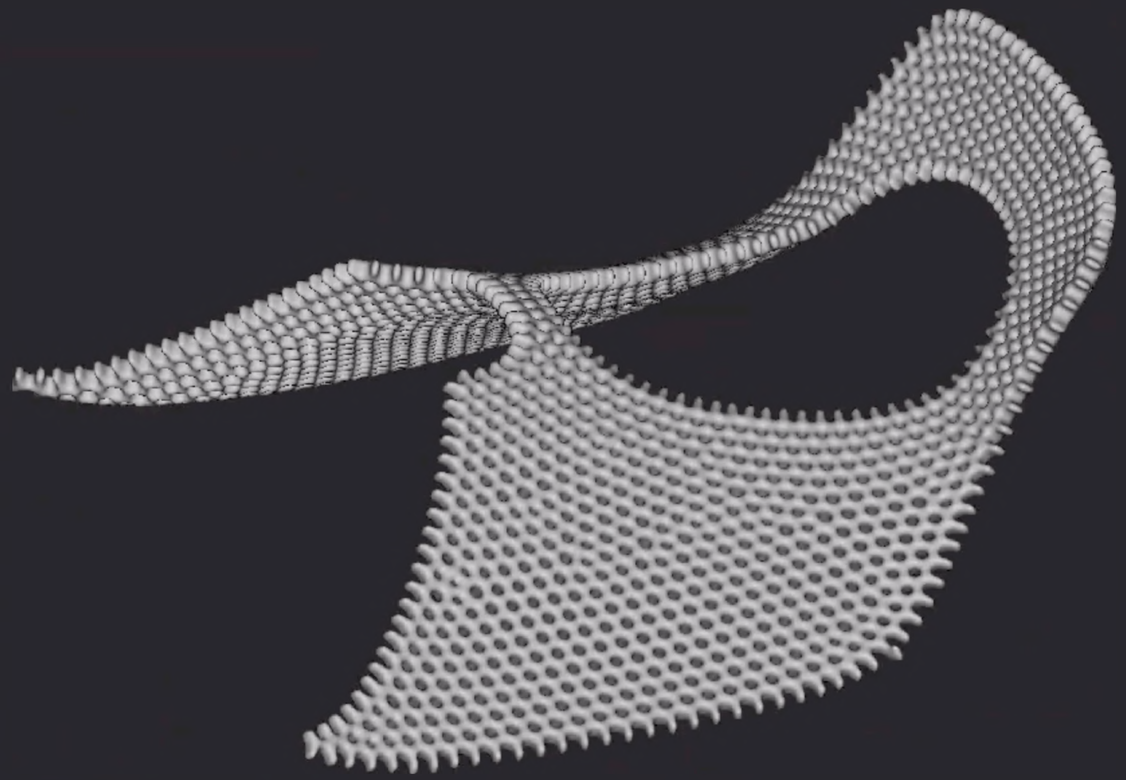
thickened interface regions: 24
attachment regions: 8





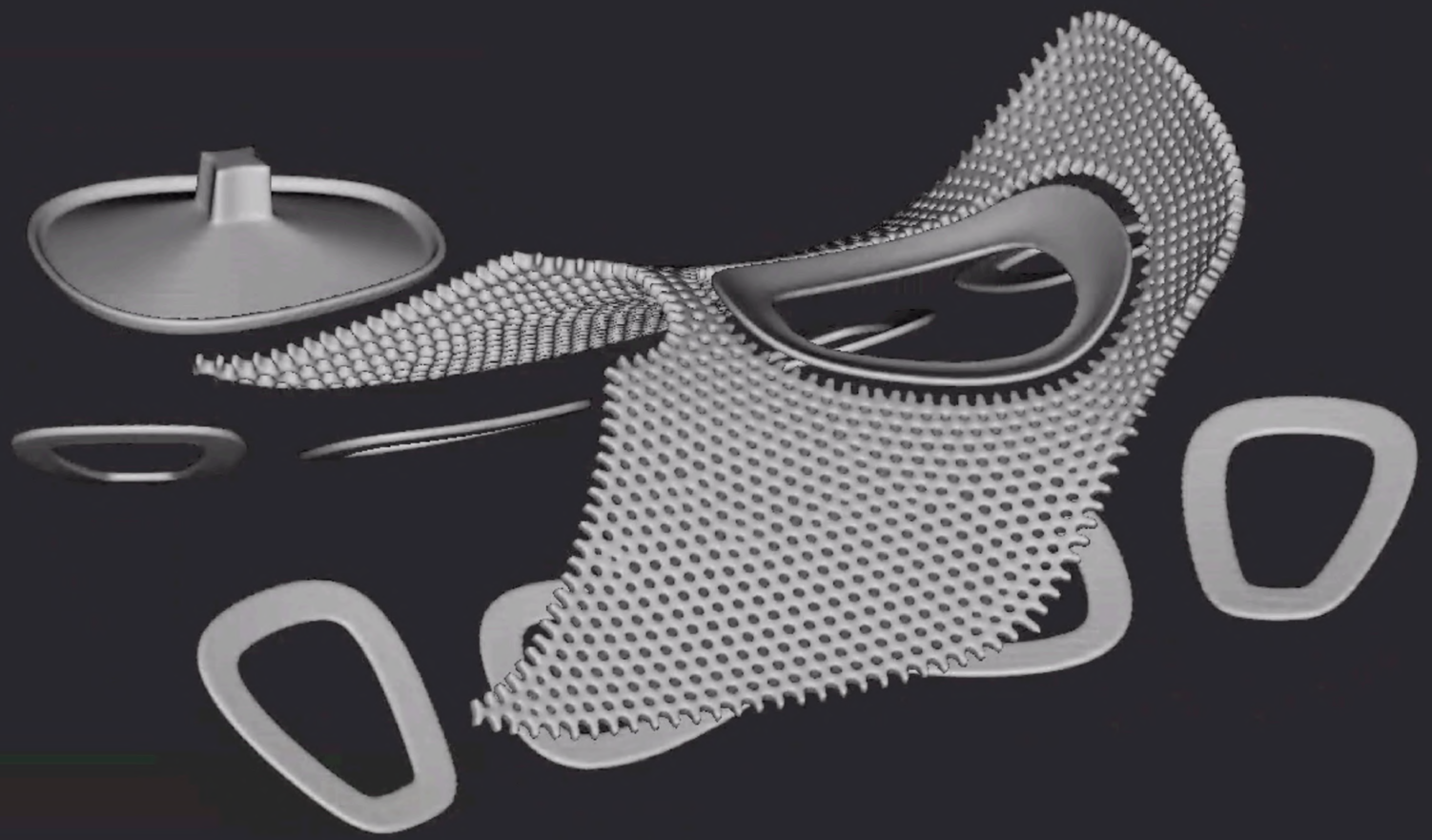
boolean iterations: 8
smoothing iterations: 3



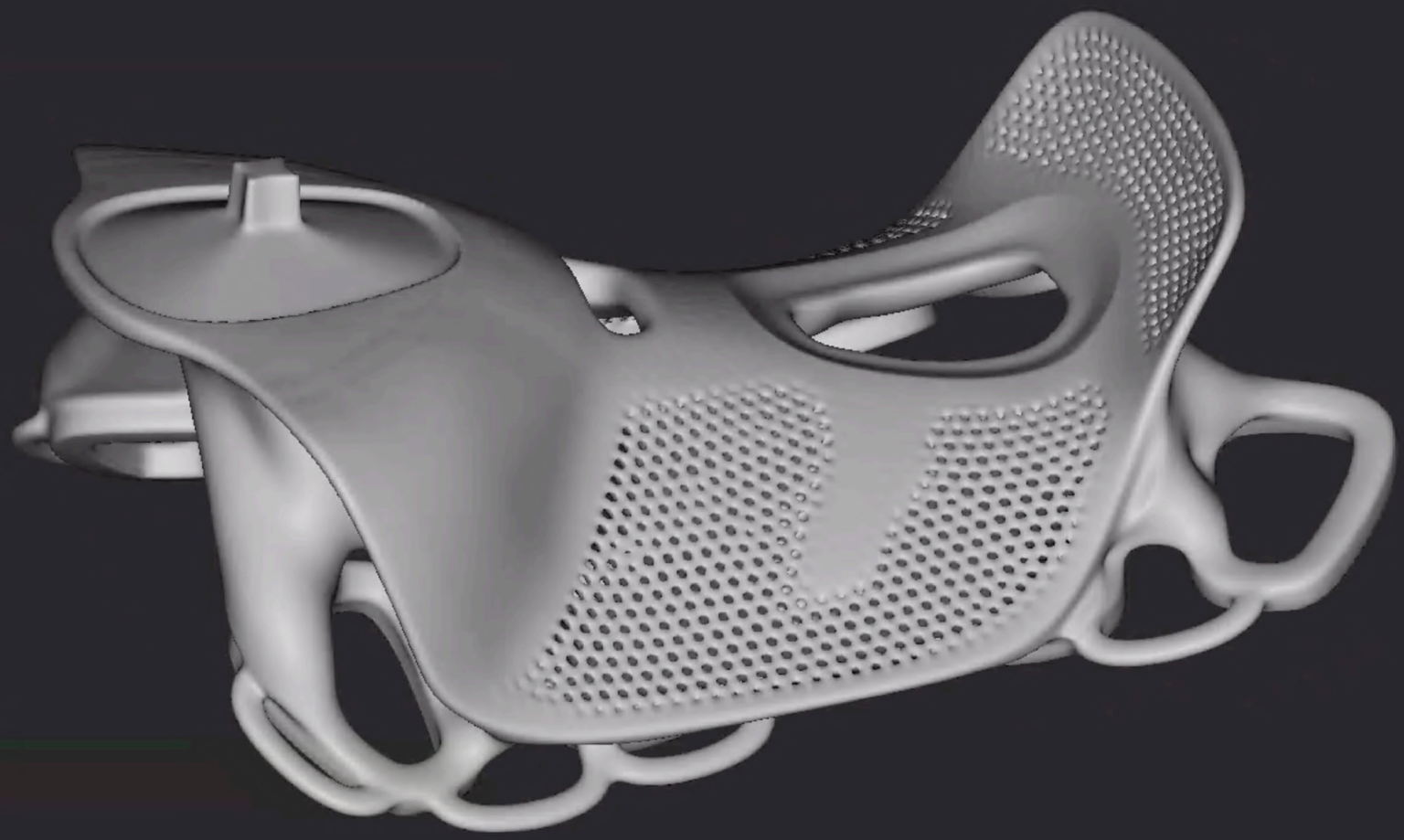


ramping factors: 2
relaxation iterations: 1000

lattice iteration: 9



final interface surfaces: 10



total line items: 1719

system:
32-core Xeon Gold
Nvidia A6000 x4
180 GB RAM

Topology Optimization

Demonstrates topology optimization on imported CAD geometry.

Search blocks... (Ctrl+L)

Inputs

Visible Bodies

final forms

pads viz — Concatenate Lists

seat viz — Empty

horn viz — horn

body viz — union 4

raw top opt

seat raw top opt viz — seat raw top ...

seat rear raw top opt... — seat rear r...

horn raw top opt viz — horn raw top...

pads raw top opt — Concatenate Lists (2)

List 1: — right pads raw t...

List 2: — mirror pads raw ...

Setting Variables

top opt settings

Mesh size — 8 mm

boundary penalty — 0

boundary penalty ra... — Ramp

Scalar field: Boolean Union — Implicit Body_128

Blend type: — Rounded

Blend radius: — 0 mm

Bodies: Implicit Body List (1... — Implicit Body ...

0: Implicit Body_1...

1: Implicit Body_1...

2: Implicit Body_1...

3: Implicit Body_1...

4: Implicit Body_1...

5: Implicit Body_1...

6: Implicit Body_1...

7: Implicit Body_1...

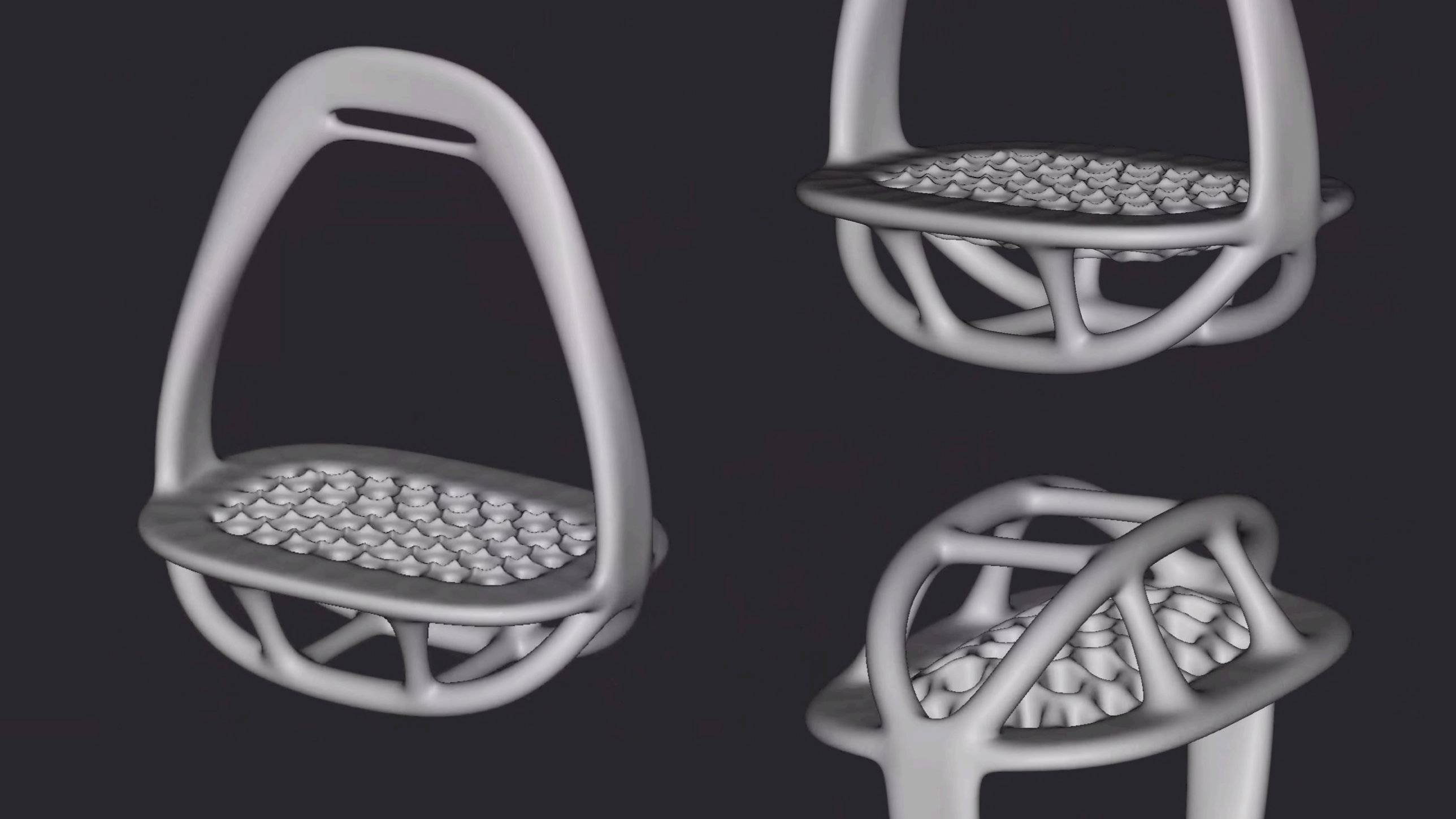
8: Implicit Body_1...

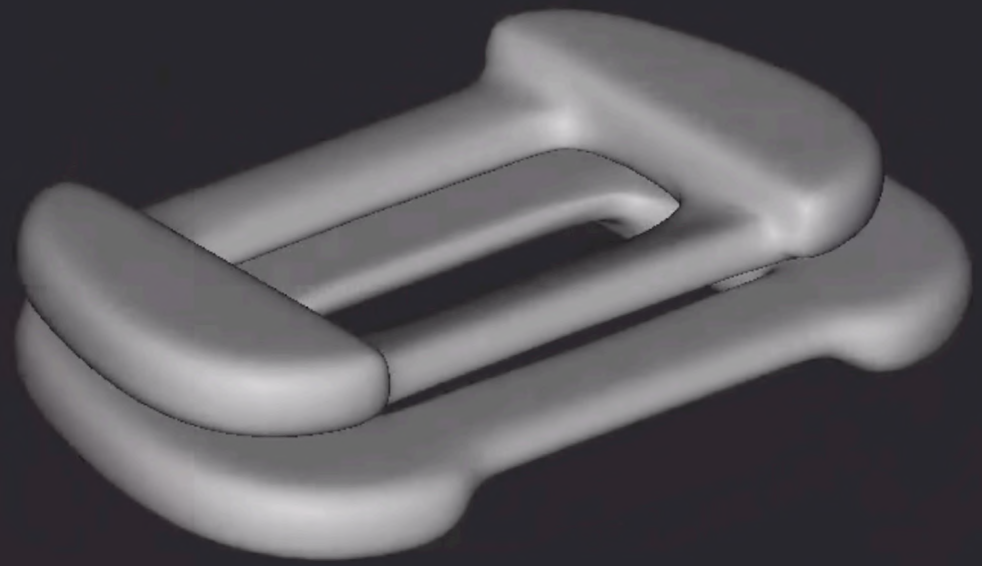
9: Implicit Body_1...

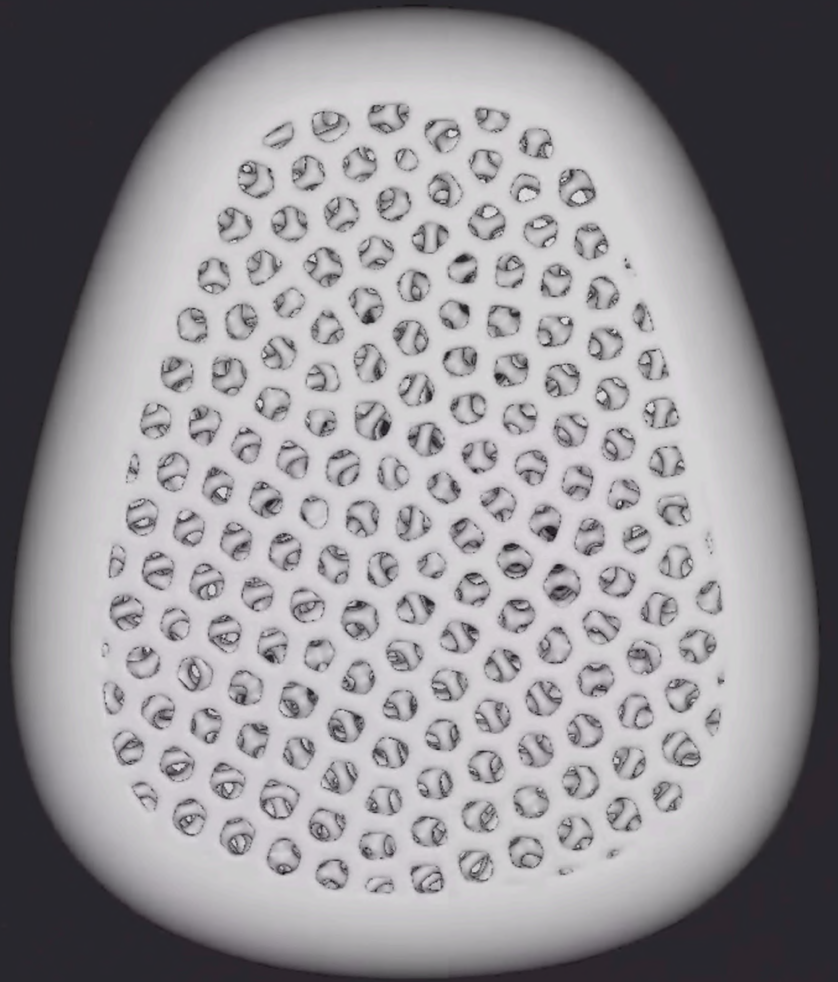
10: Implicit Body_1...

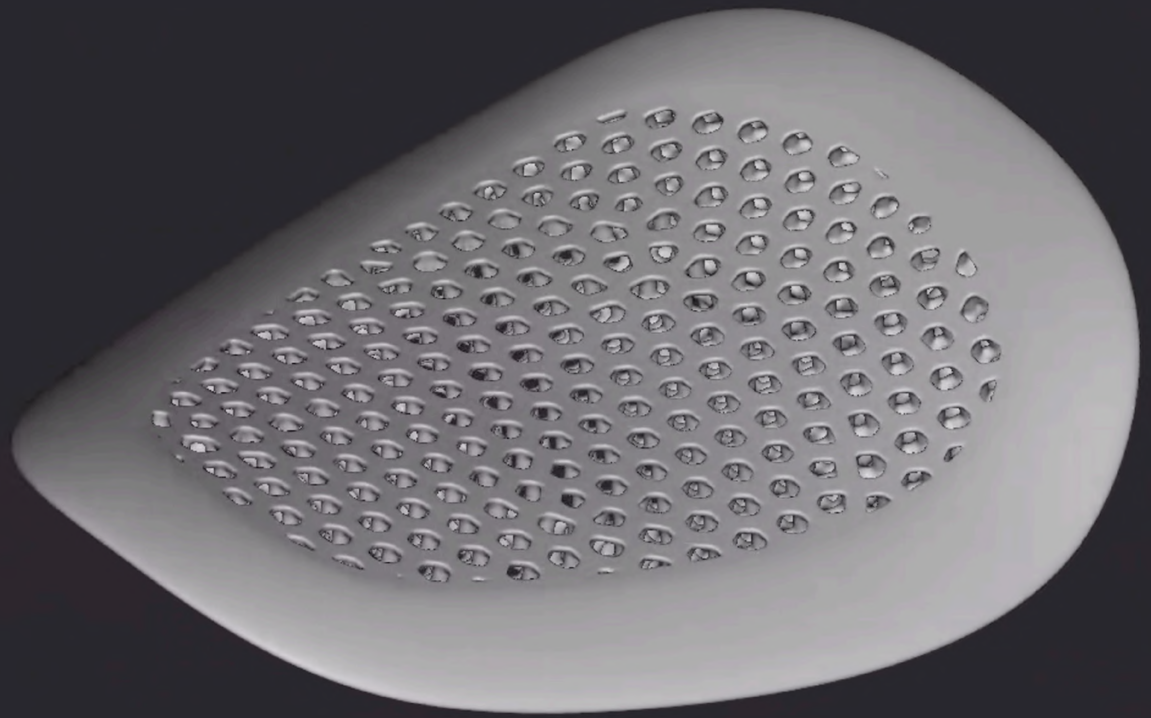
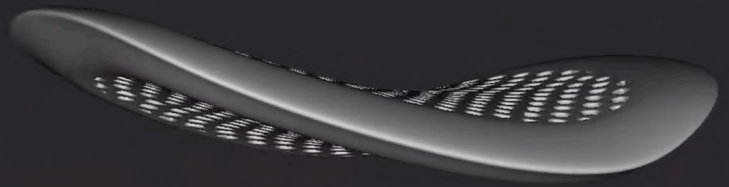
11: Implicit Body_1...

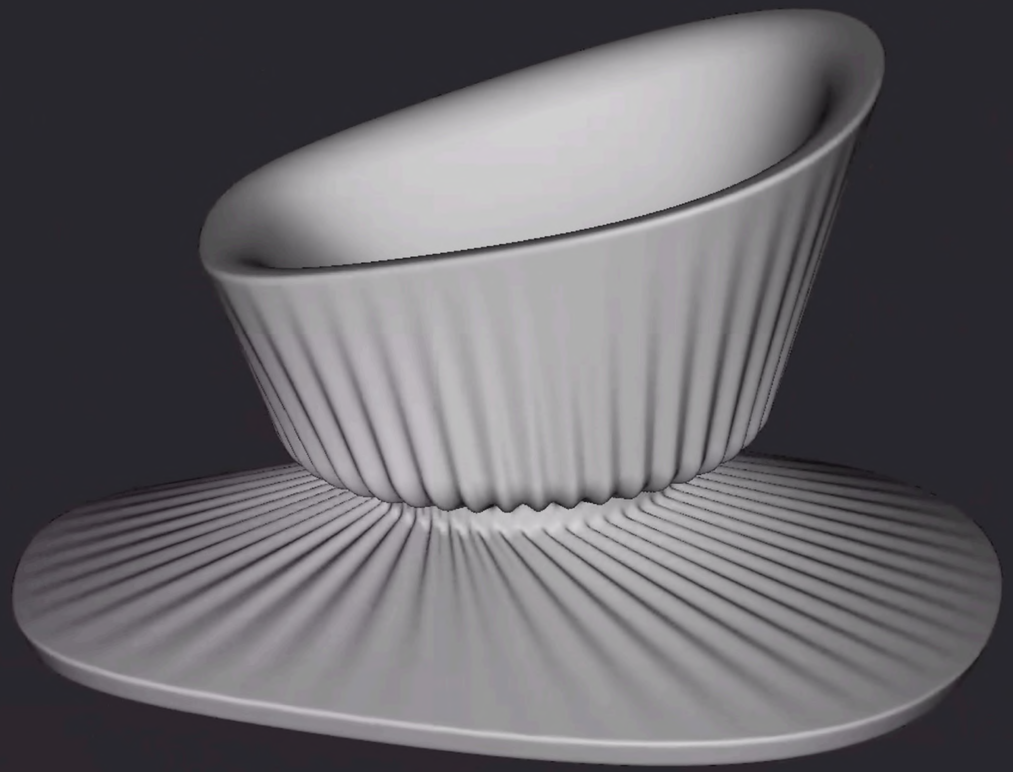
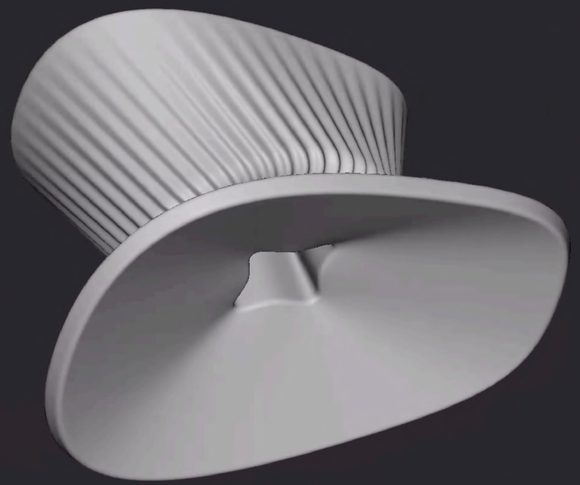
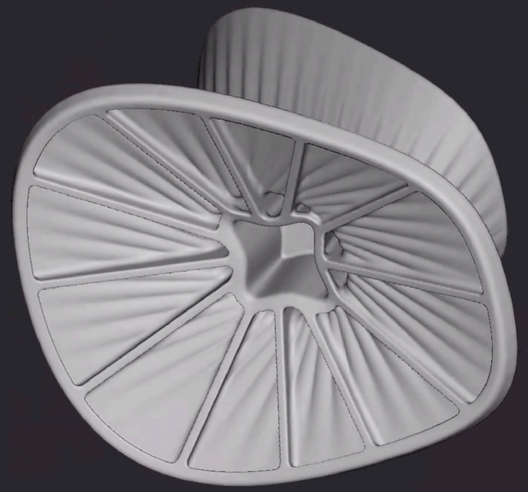
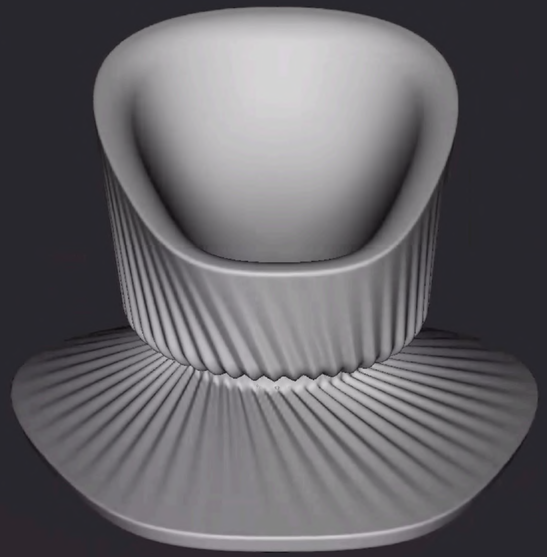
Output:

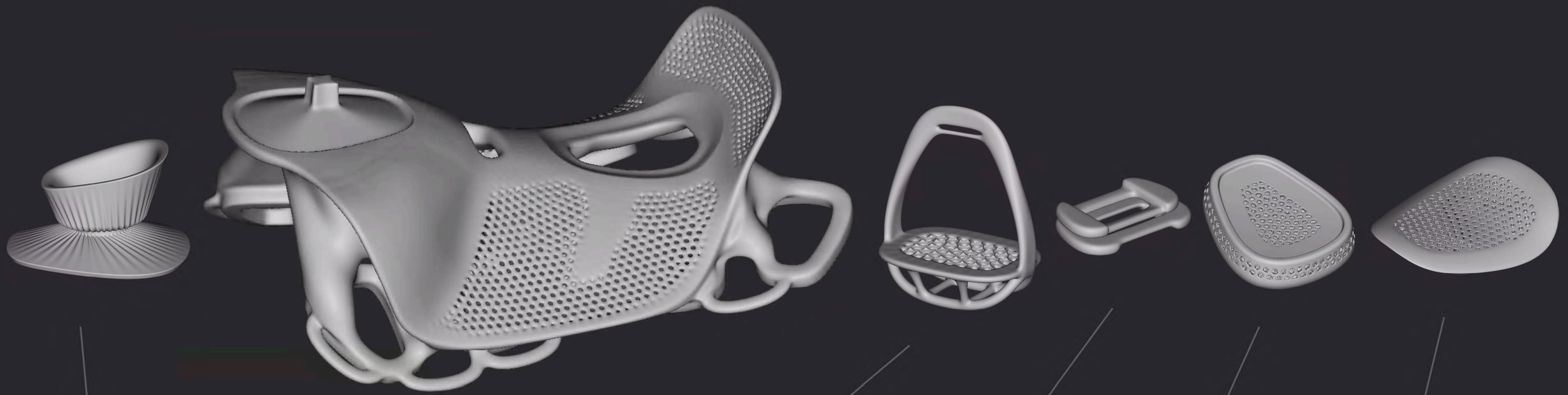






horn x1

- DMLS aluminum
- SLS nylon (proto)

body x1

- FDM nylon-wrapped carbon-core filament
- SLS nylon (proto)

stirrup x2

- DMLS aluminum
- PETG FDM (proto)

buckles x8

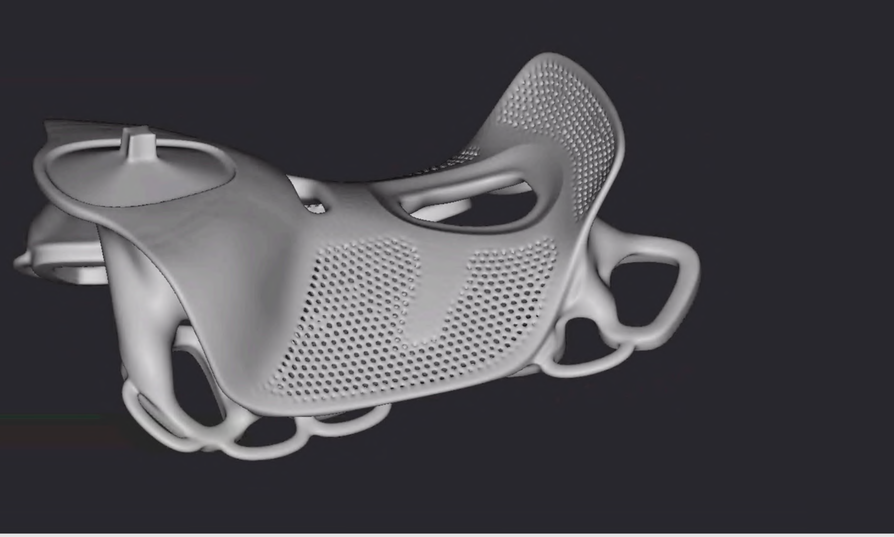
- DMLS aluminum
- SLS nylon (proto)

pad x8

- SLS TPU
- SLA Flexible 80A Resin (proto)

seat x1

- SLS TPU
- SLA Flexible 80A Resin (proto)

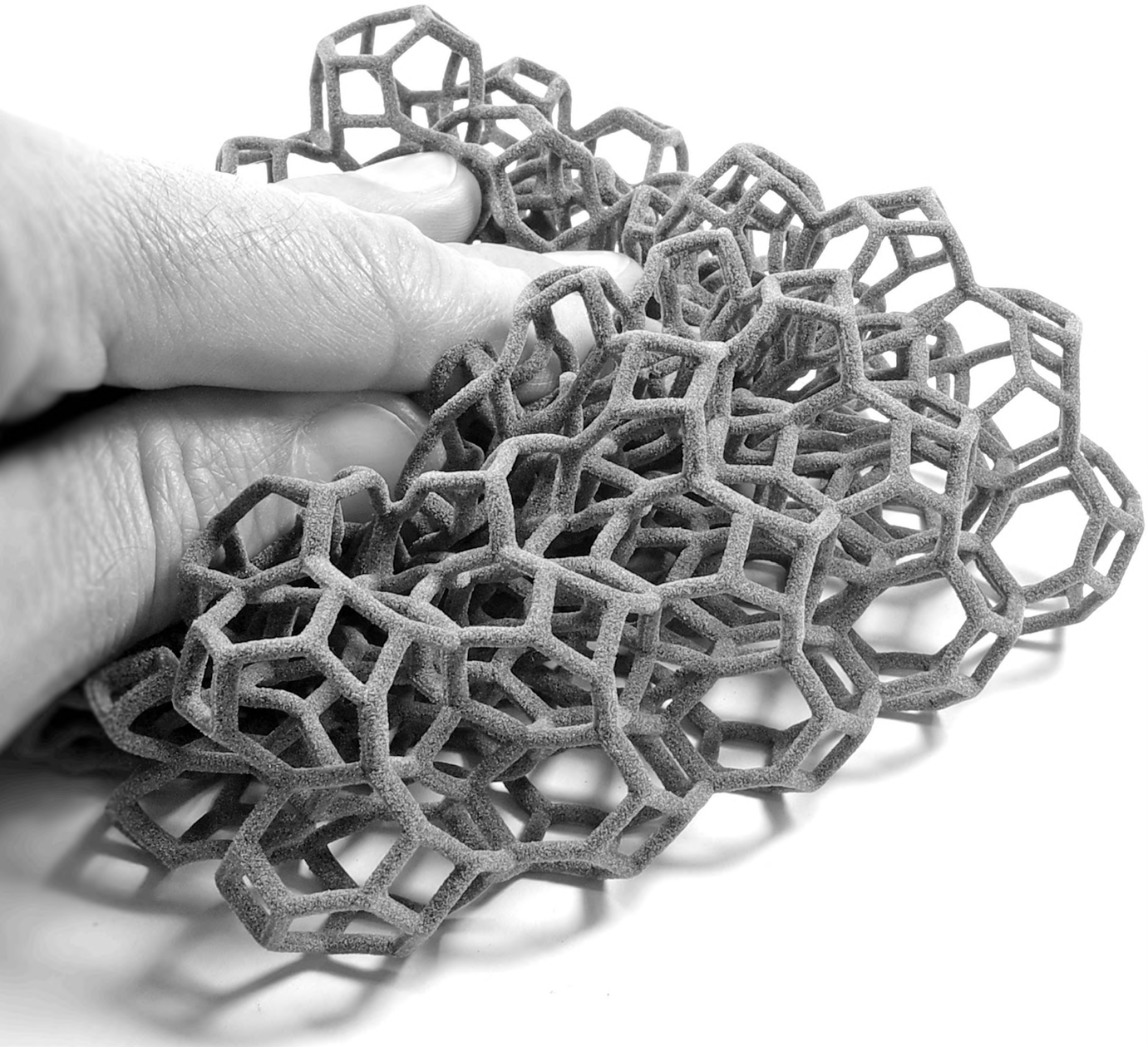


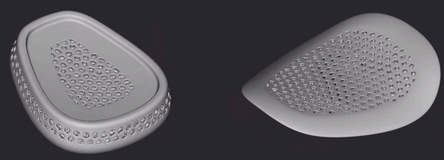
Carbon-core nylon FDM

Fused deposition modeling. Superstrata builds custom bike frames using 3D printing. They use a carbon filament wrapped in nylon. Their bike frames are more impact resistant than any CFRP bikes.

Aluminum DMLS

Direct metal laser sintering. Aluminum to minimize weight. Provides durable surfaces for the rope, webbing, and footbeds.



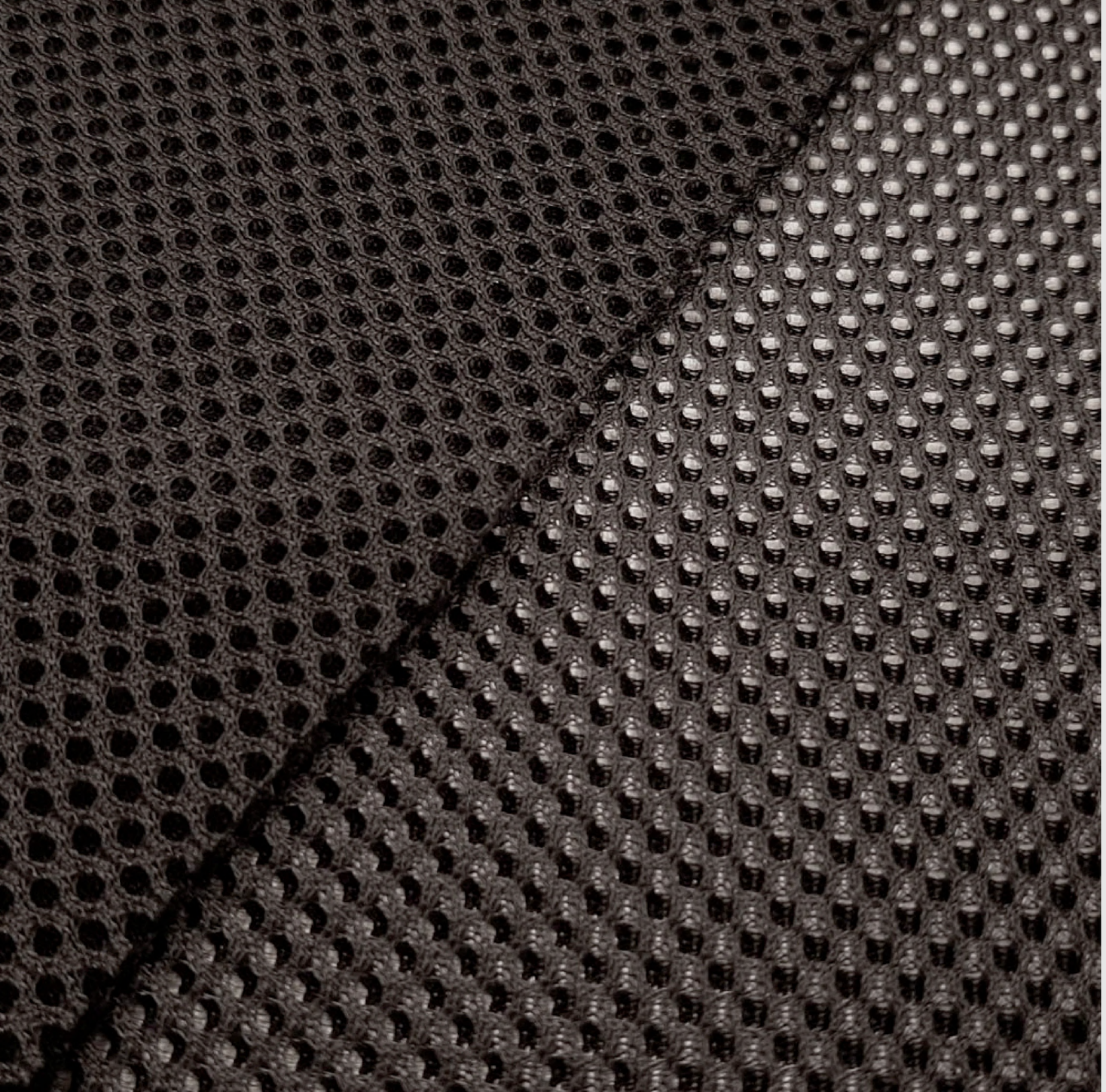


TPU SLS

Thermoplastic polyurethane selective laser sintering. SLS is great for complex structures. The prototypes are Formlabs 80A resin.

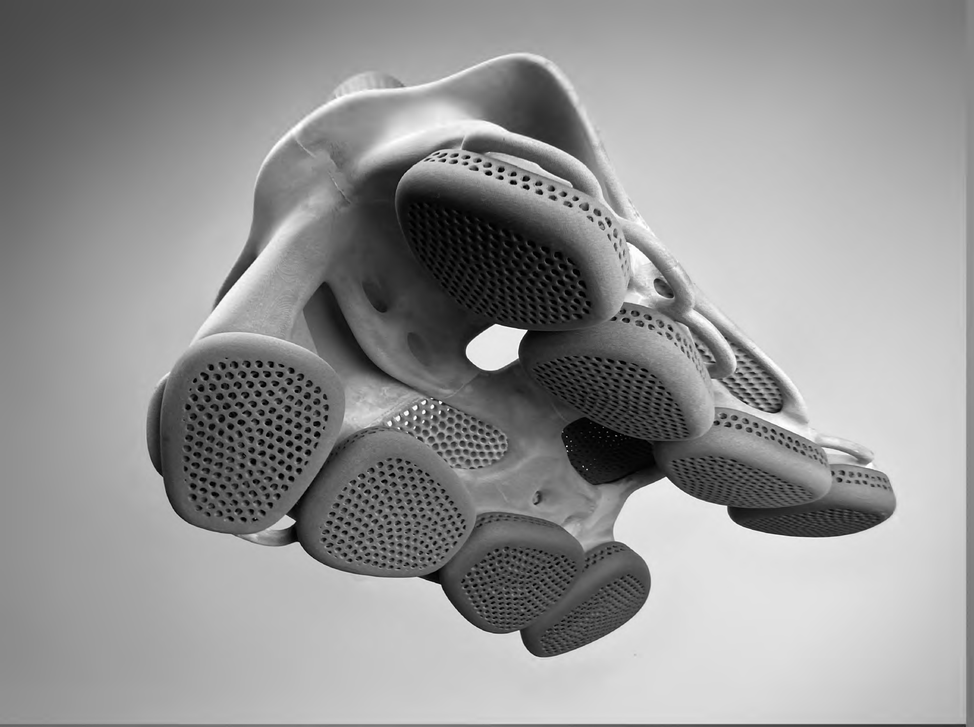
Polypropylene Webbing

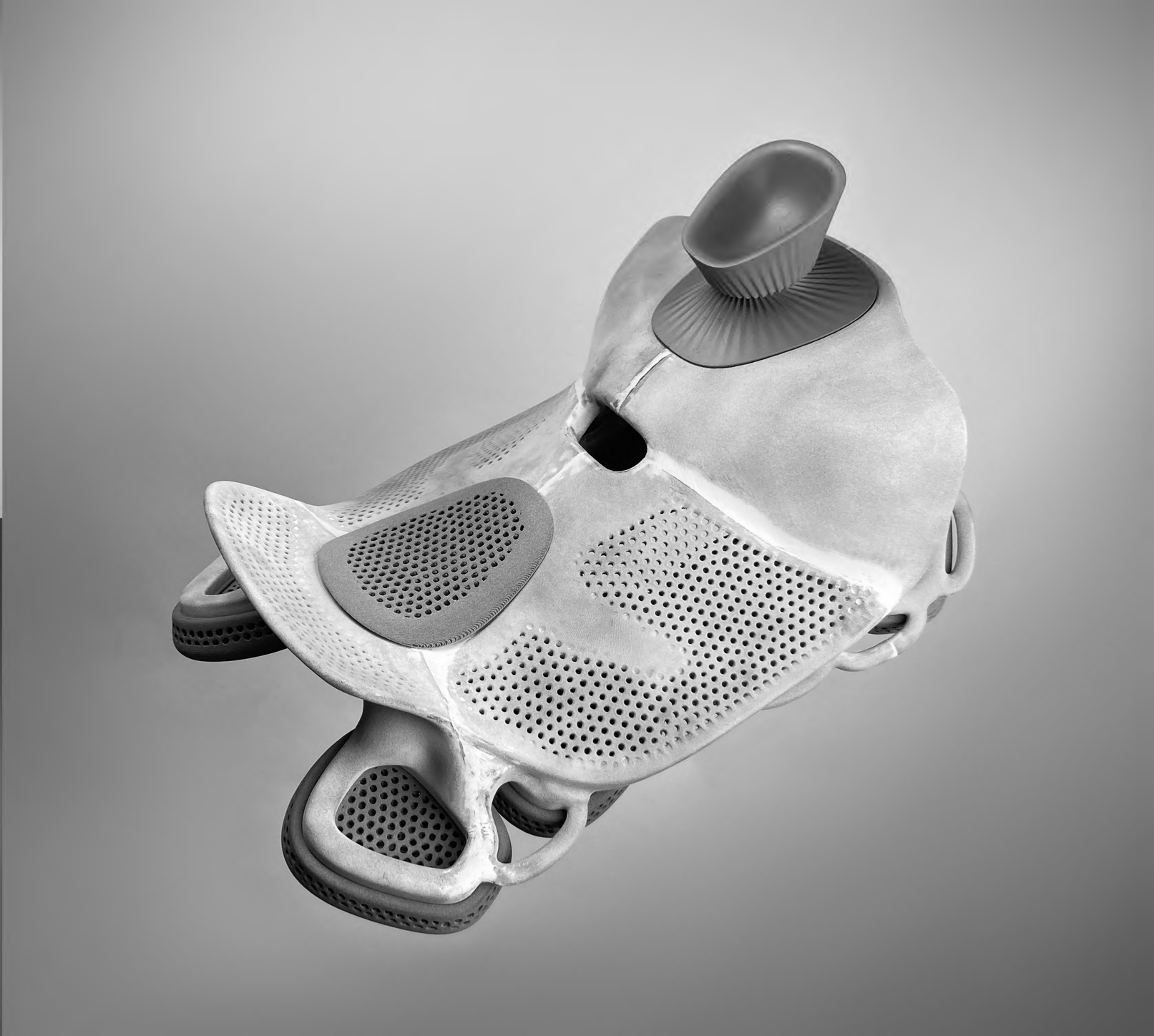
Does not stretch when wet, unlike nylon webbing. Falling from a horse is dangerous, so fit security takes precedence.

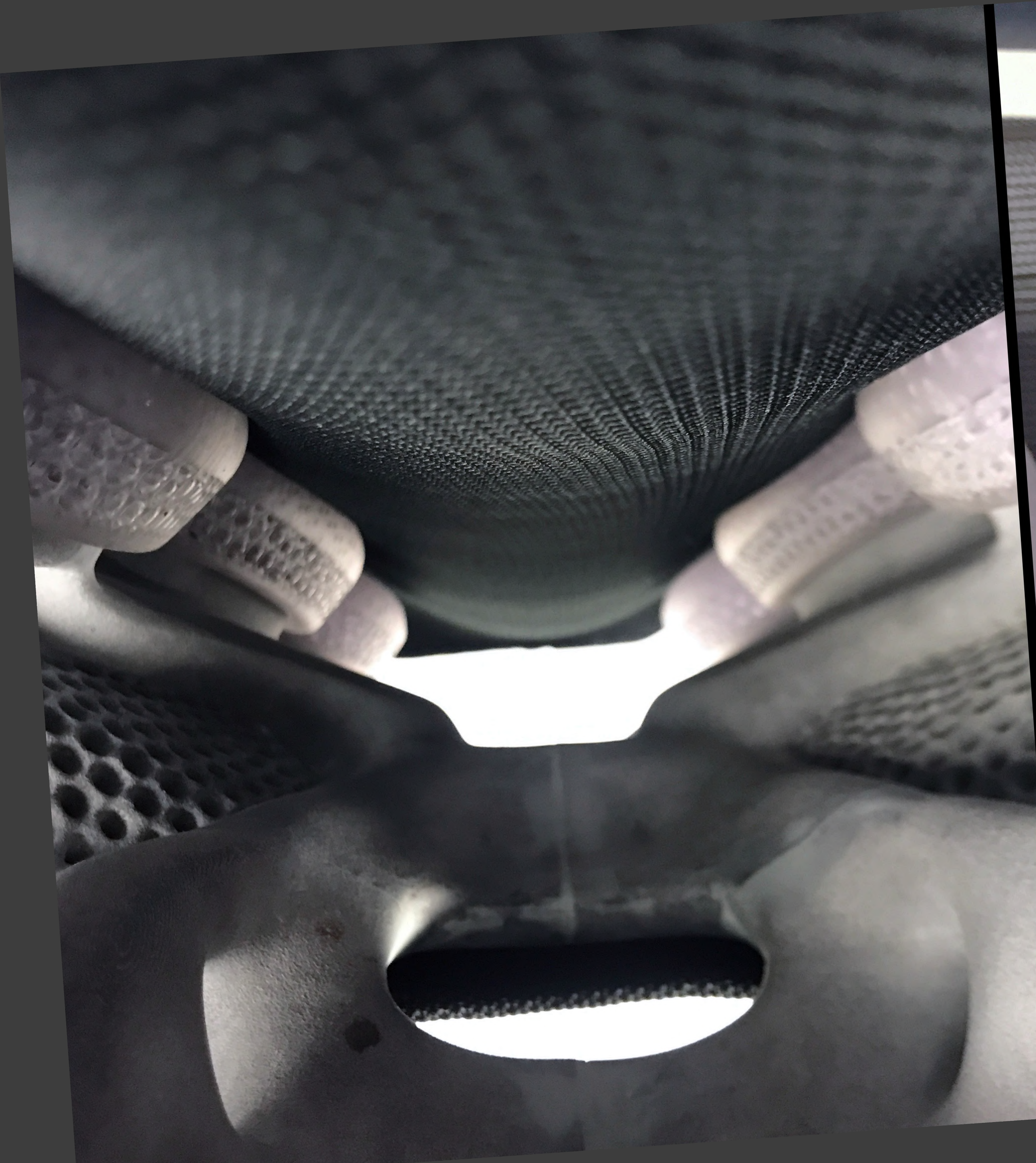


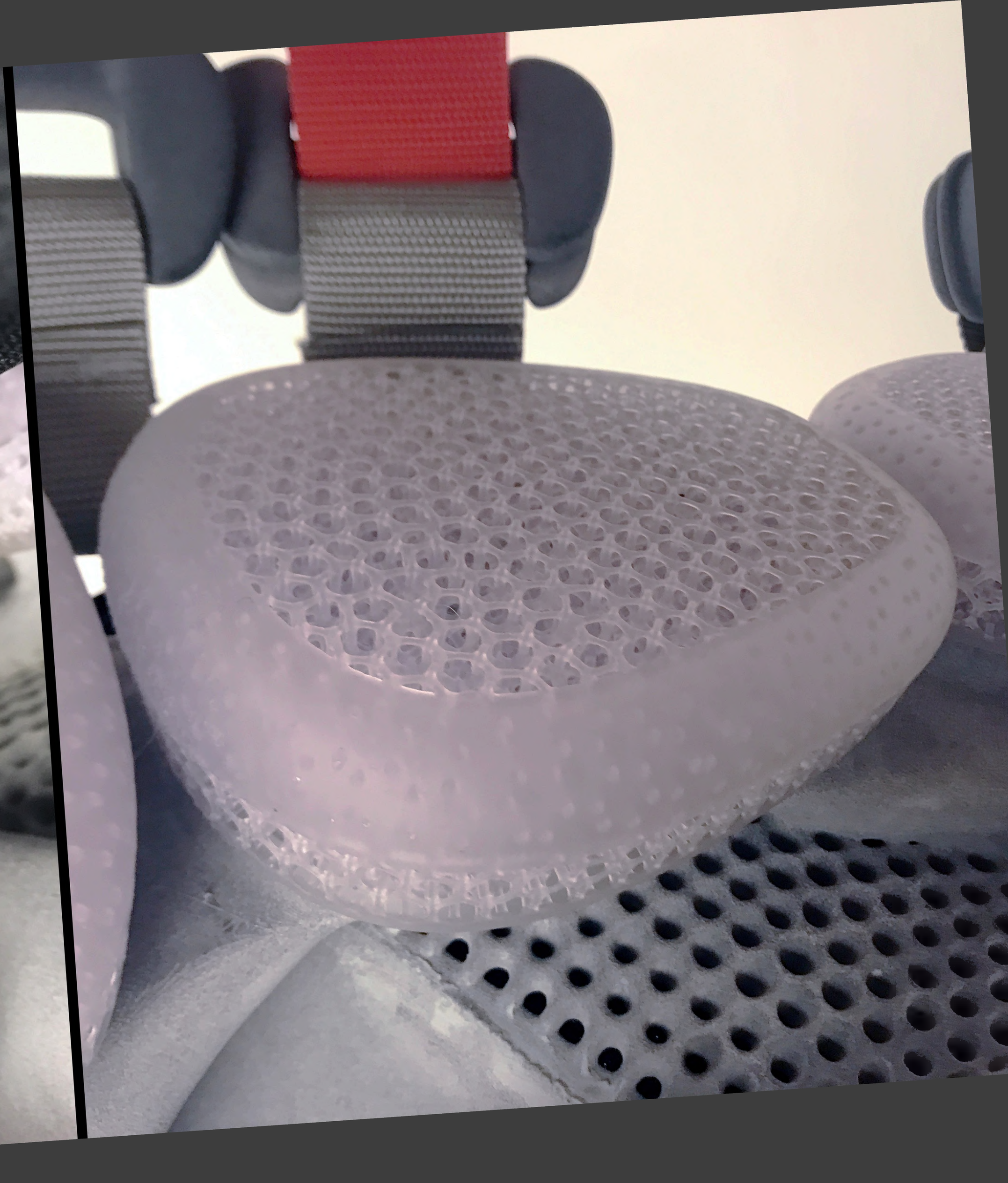
Spacer Mesh

Robust for high friction environments. Provides breathability when used next to skin. Precedents in backpacks.

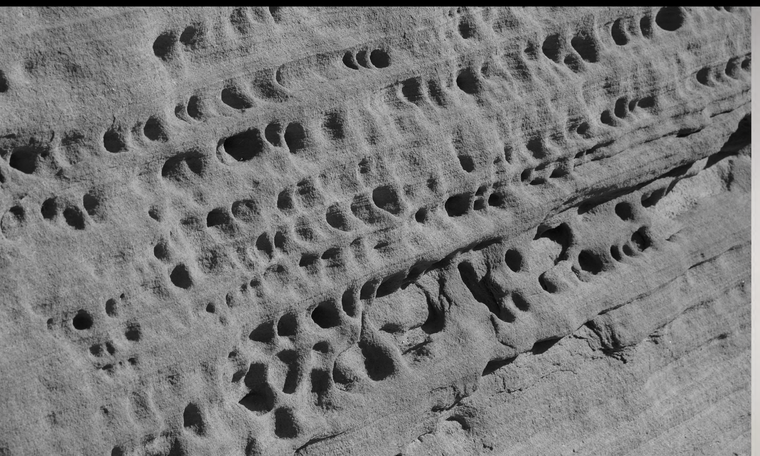


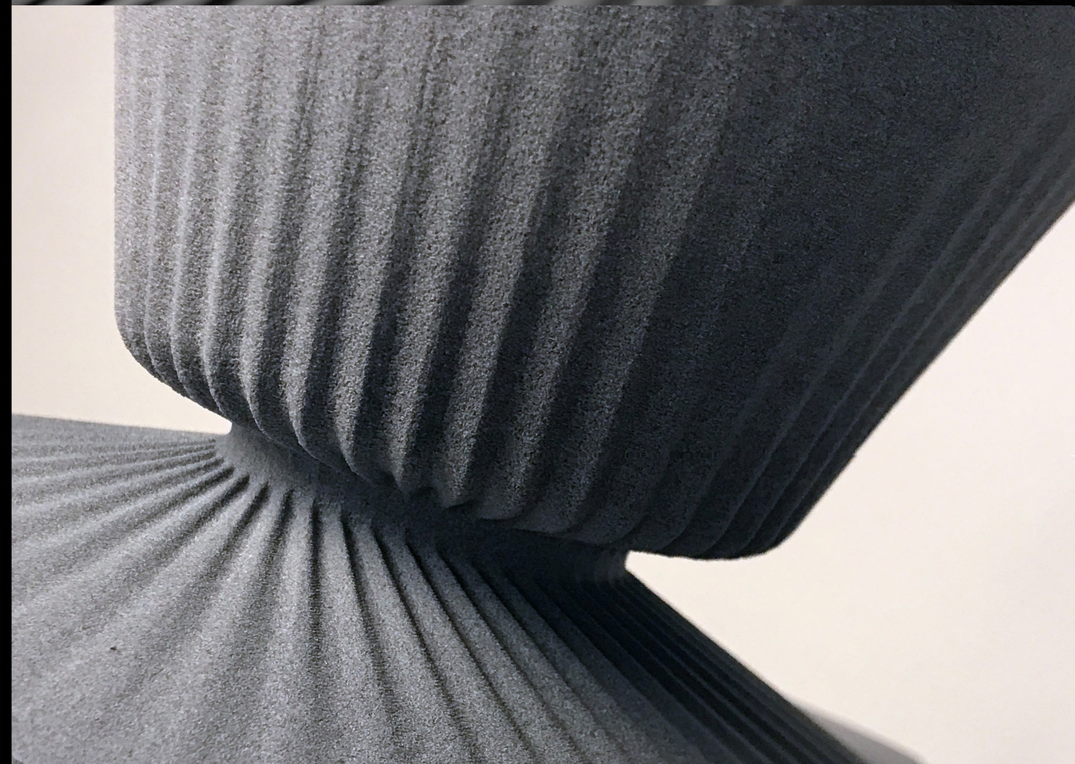






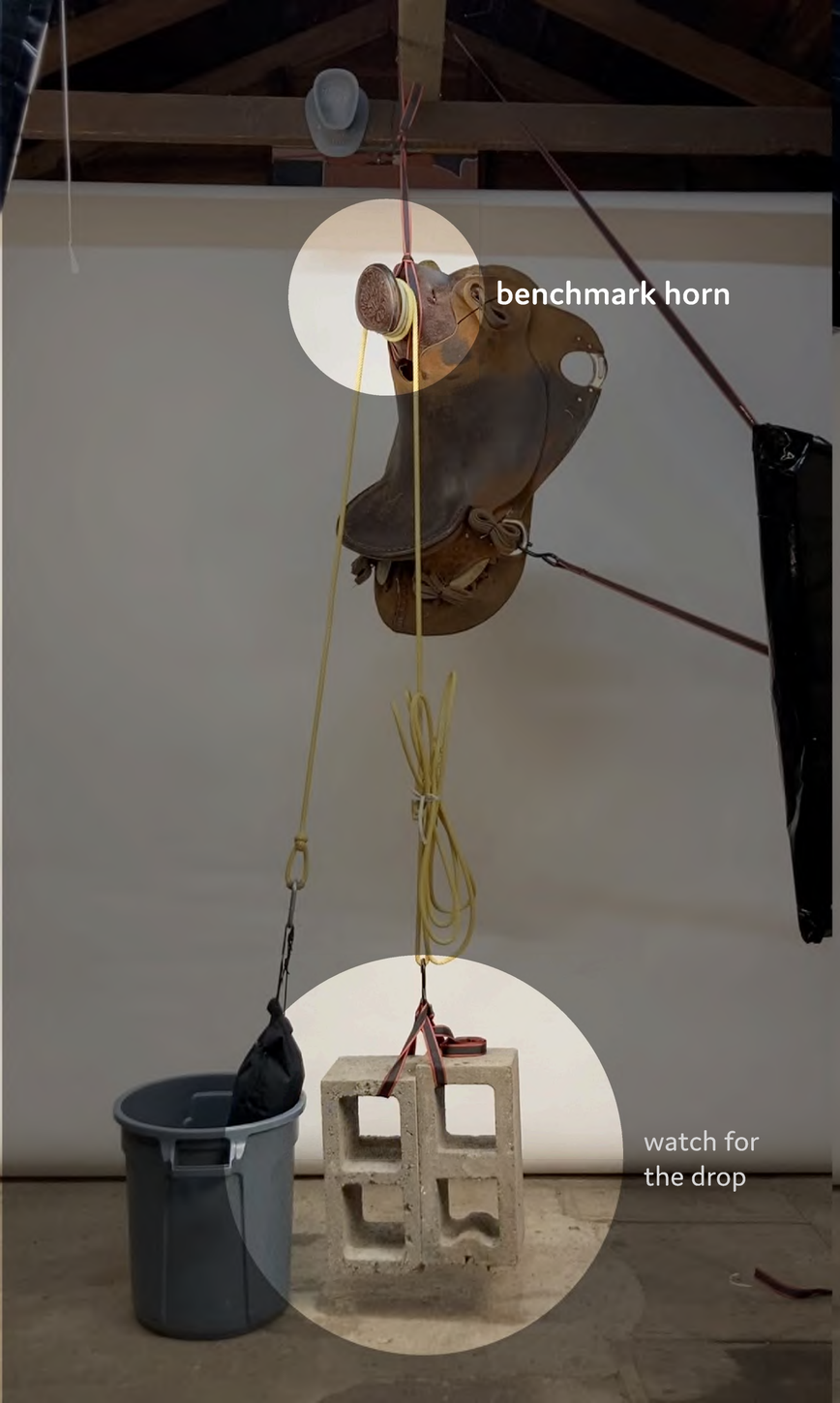






Total new saddle weight:

17.2 pounds



Benchmark horn coefficient of static friction:

0.962

New horn coefficient of static friction:

> 0.987

- See Capstan equation to calculate friction of multiple loops
- Test referred to by climbing folks

$$F_s = \mu_s N$$

F_s = Force of static friction.

μ_s = Coefficient of static friction.

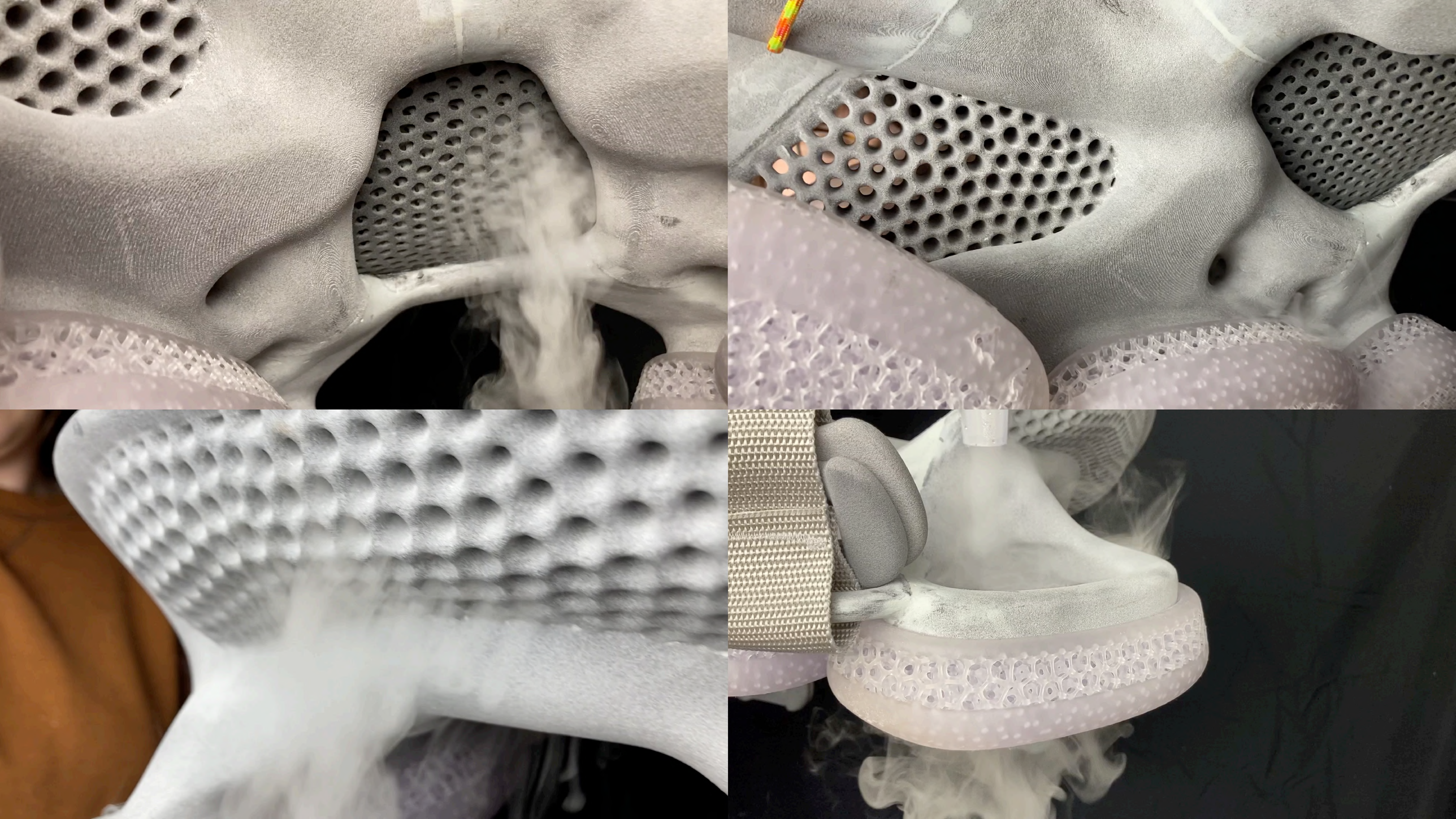
N = Normal force.

Benchmark saddle breathability:

Handle: Moderate
Seat: None
Sides: None
Padding: None

Windswept saddle breathability:

Handle: High
Seat: High
Sides: High
Padding: High



Metrics for success

SUCCESS 1. Horn has equal grip to existing horns without needing wraps

SUCCESS 2. Saddle weighs half of current saddles

SUCCESS 3. Airflow is directed through the saddle with better overall breathability

SUCCESS 4. Padding system allows next-to-skin breathability

“I have several riders that would really appreciate how light it is.”

“As cool as the saddle is, the fact that I could have a saddle made specifically for my horse is awesome.”

WINDSWEPT SADDLES

We use 3D scanning and printing to deliver the best performing, best fitting saddles.

LEARN MORE

Future development notes:

- **Explore combining body and pads into a single (possibly shore 90A) print**
- **Further minimize DMSL volume**
- **Build out accessory offerings**

Thanks:

Wilson Ranch, Jim Karn, Alli Sloop, James Tuttle, Susan Sokolowski & Rachael Volker