

DANIEL LEE

Design Case Studies

Agenda

01 **Equilibrio di Primat**

A wine decanting cradle

02 **Flow Trigger Adapter**

FEA / CFD analysis

03 **Injector Module**

Advanced surfacing / DFMA

04 **Evolve**

Pneumatic Infusion Pump

05 **Zip Clean**

Airveyor Cleaning Bot

06 **Haptic Feedback VR Controller**

Startup company mechanical design

07 **UAFX**

Hardware validation & standardization

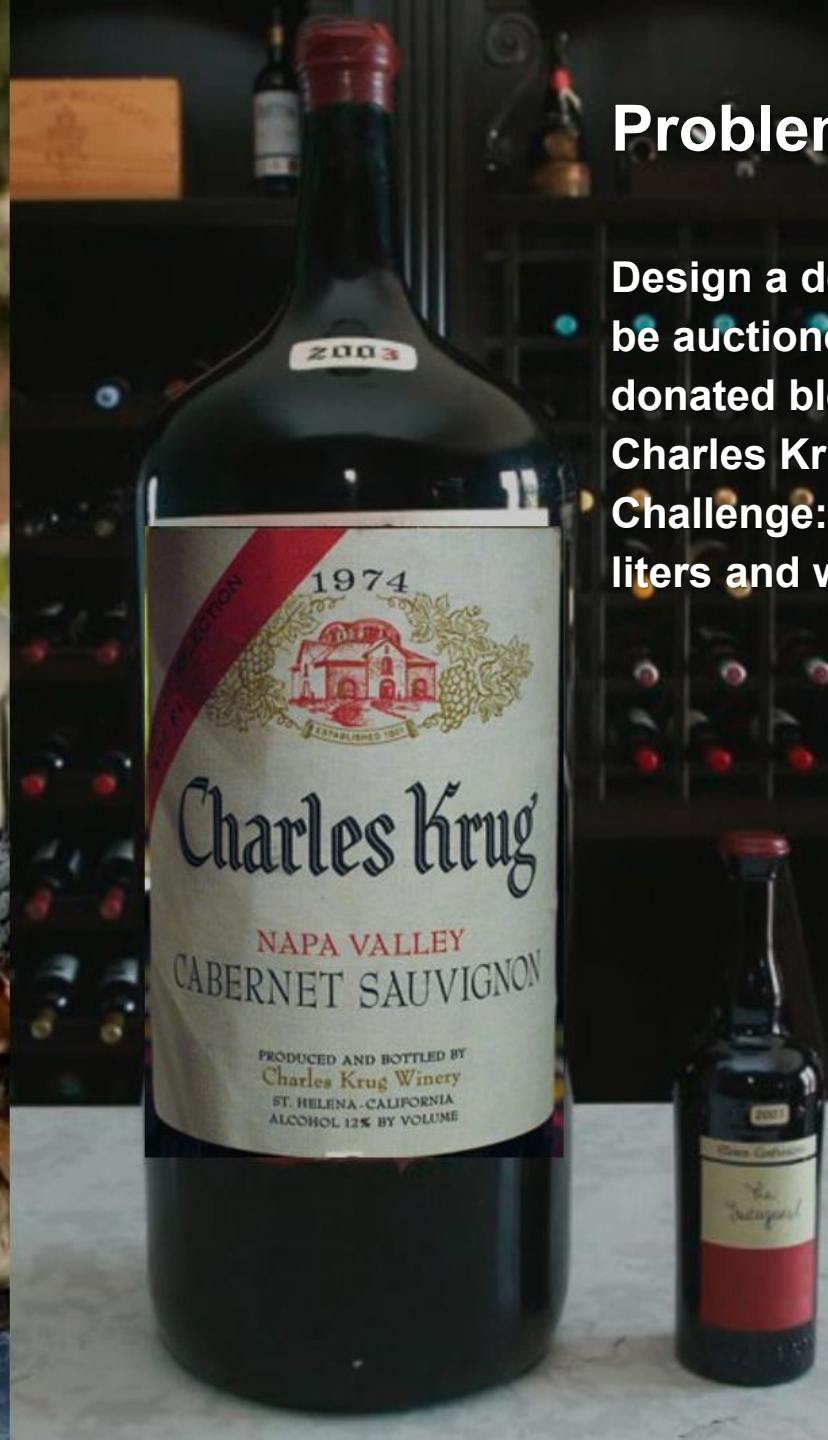
08 **Ryynstal**

Invention: Modular Golf Club Platform

01

Equilibrio di Primat

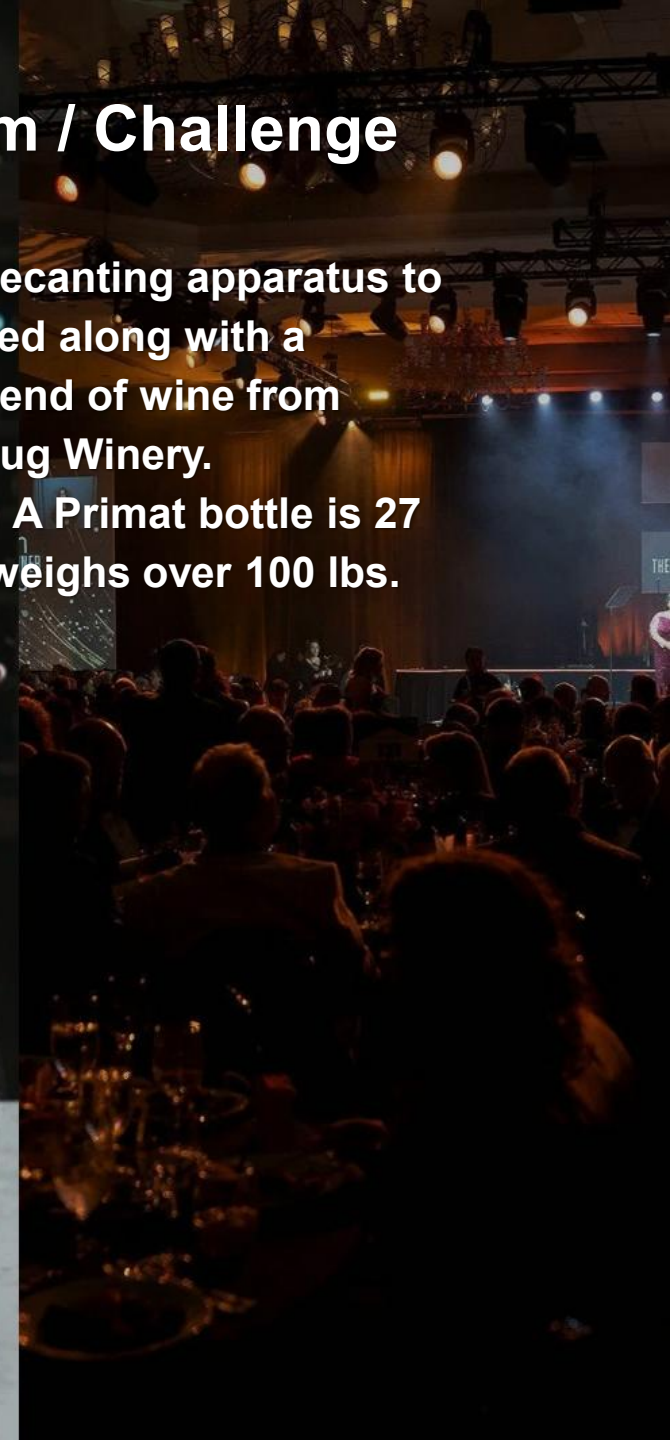
Charles Krug



Problem / Challenge

Design a decanting apparatus to be auctioned along with a donated blend of wine from Charles Krug Winery.

Challenge: A Primat bottle is 27 liters and weighs over 100 lbs.



01

Equilibrio di Primat



Action

A volunteer team of 8 graduate design students and the head of the engineering department.

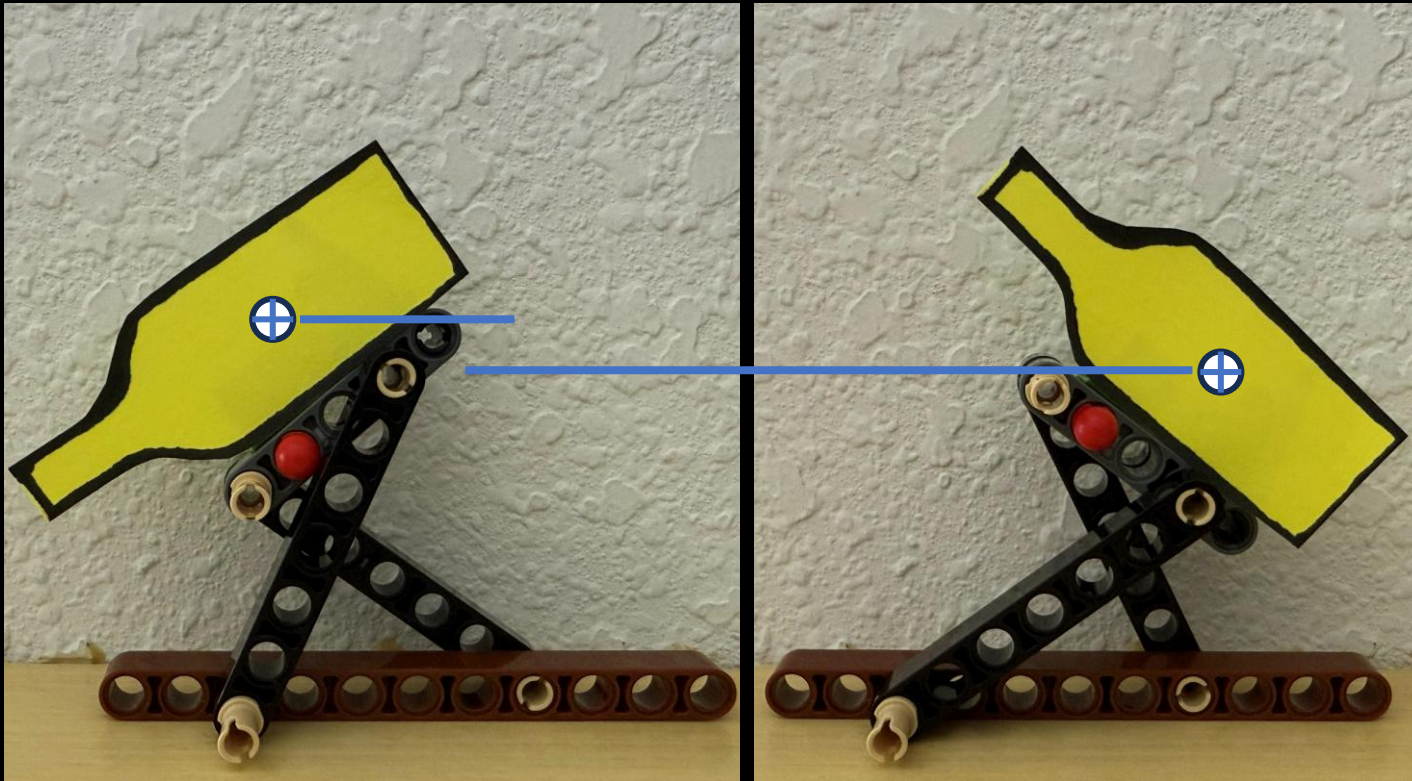
- Charity
- Challenge & Fellowship
- Final Boss Test – for my design education



STANFORD PRODUCT
REALIZATION LAB

01

Equilibrio di Primat



Action

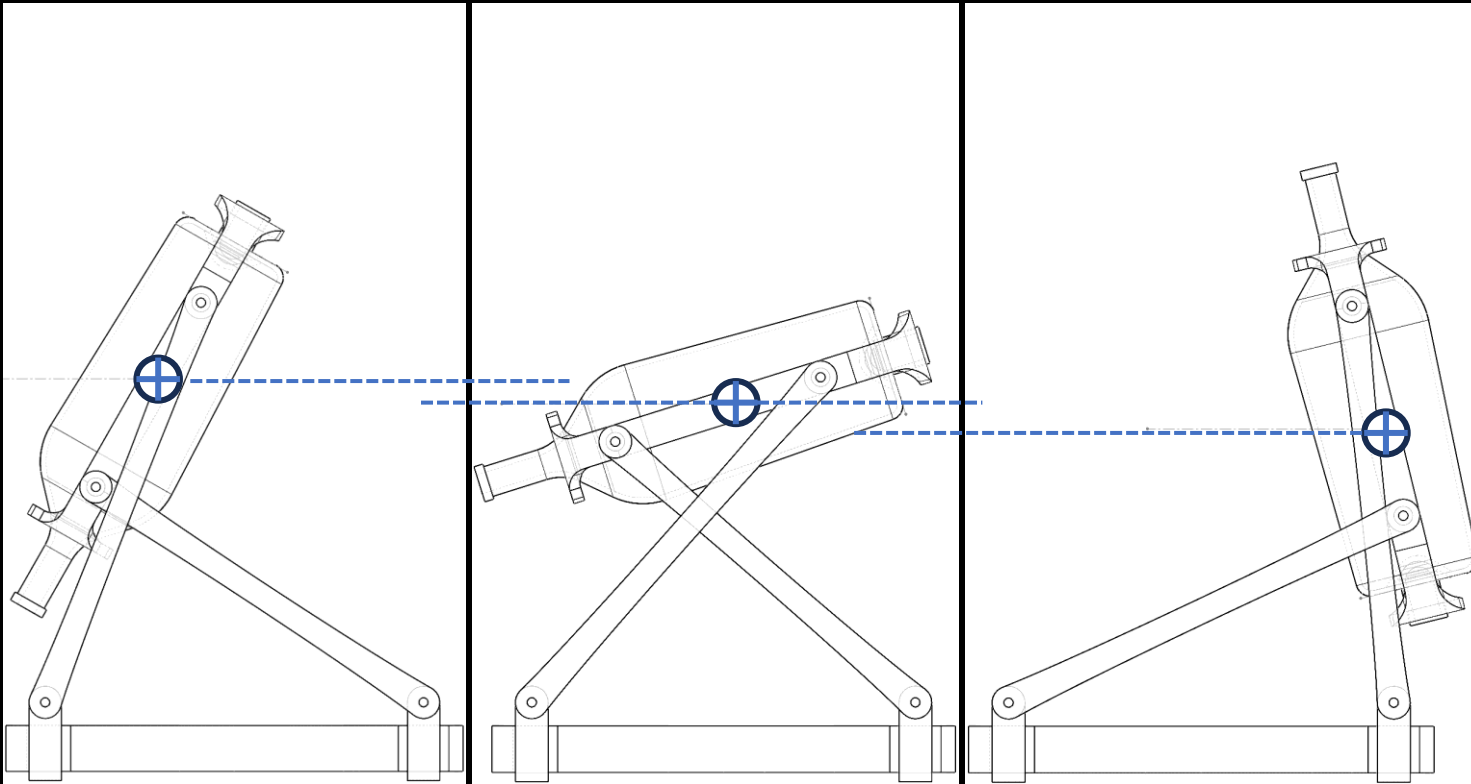
Exploit mechanical advantage of 4-bar linkage in an X configuration.

Theory: conservation of energy would suggest that the potential energy of lifting 100 lbs. a few inches - could be equivalent to a lower force push at low friction, over several feet.

- Direct human input - no elastic energy
- Solely mechanical advantage & gravity
- Stable, simple, easy, intuitive interaction
- Linkage lengths and pivots finely tuned to gently right itself back upright

01

Equilibrio di Primat



Action

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01

Equilibrio di Primat



Action

1:1 full scale validation prototype.

User testing and verification at full and partial volumes. Identified high volume flow surge mitigation plan using a vented pour nozzle.

- Functional testing
- Geometry tuning
 - Retain upright – back return bias
 - While minimizing input force
- Sangria House Party – verification testing

01

Equilibrio di Primat



01

Equilibrio di Primat



Result

“Equilibrio di Primat – A Wine Decanting Cradle”



- On-time delivery
- Successful fundraiser
- Team members gifted commemorative wines
- IDSA award winning

02

Flow Trigger Adapter

INOmax[®]
(nitric oxide) GAS FOR INHALATION



 rynstal



Problem / Challenge

Make a breathing circuit adapter that serves as a pressure sensor valve to detect breath – for an inhalant therapy to be precisely delivered while minimizing the stress on a vulnerable patient.

02

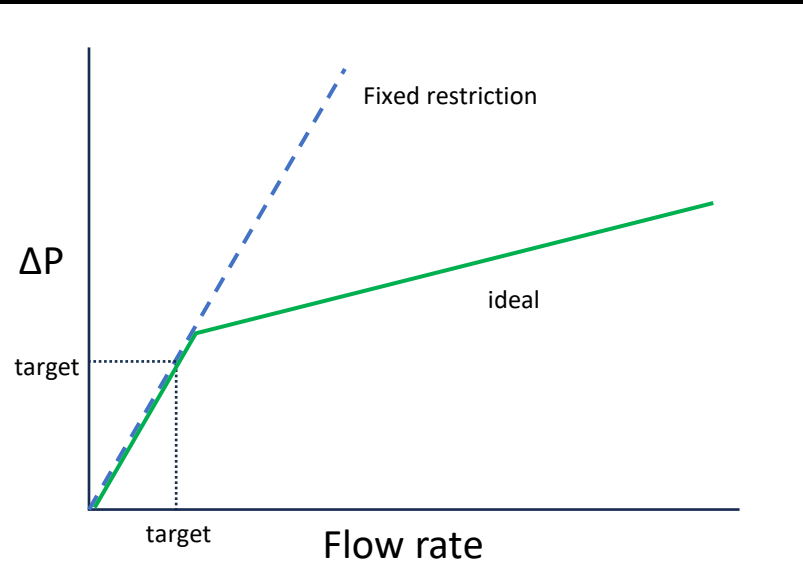
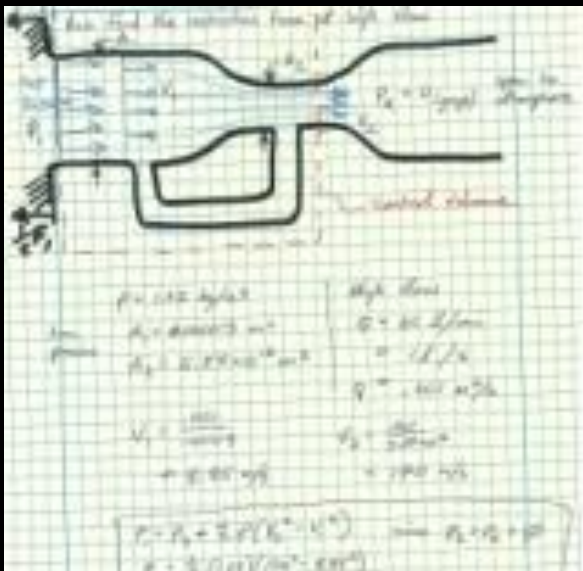
Flow Trigger Adapter

Bernoulli Equation Application: $P_1 + \frac{1}{2} \rho v_1^2 = P_2 + \frac{1}{2} \rho v_2^2$.

Mechanism: When the pipe cross-sectional area decreases (1 to 2), the flow velocity (v) must increase to satisfy the conservation of mass (continuity equation: $A_1 v_1 = A_2 v_2$).

Pressure Drop Equation: The pressure P_2 at the constriction is lower than the upstream pressure P_1 .

Formula: $\Delta P = P_1 - P_2 = \frac{1}{2} \rho (v_2^2 - v_1^2)$.



Action

Given a target pressure drop at a certain flow rate for the trigger algo, we can calculate the theoretical restriction size.

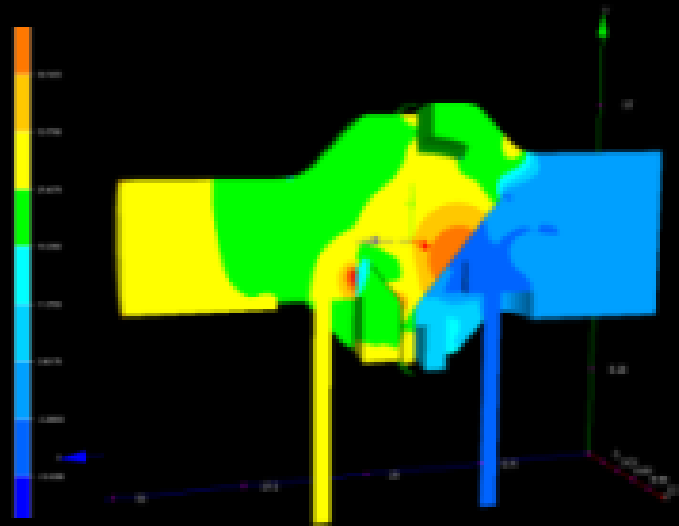
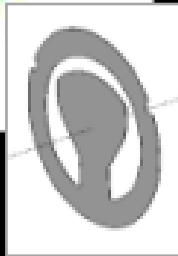
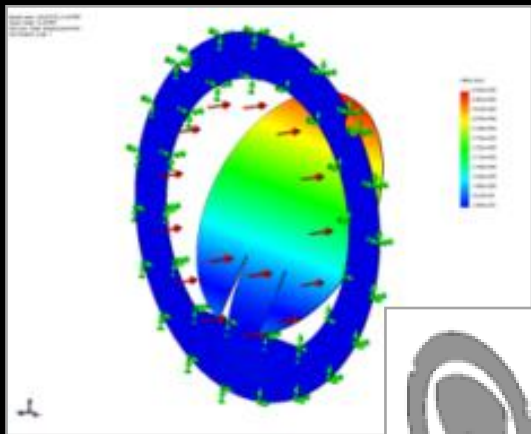
But a static would be too restrictive at the during the main part of the breath.

Need a design that behaves like small restriction at start of breath, then opens up after trigger.

- Start of breath behave like small restriction
- After trigger, opens up to enlarge restriction
- Suggests a form of spring-loaded valve

02

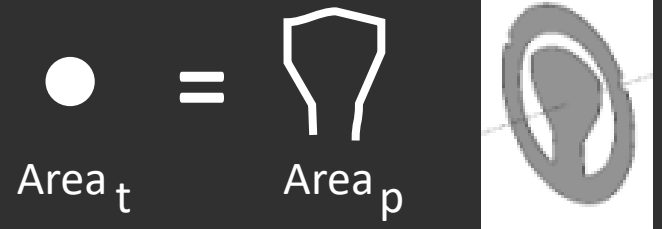
Flow Trigger Adapter



Action

Insight:

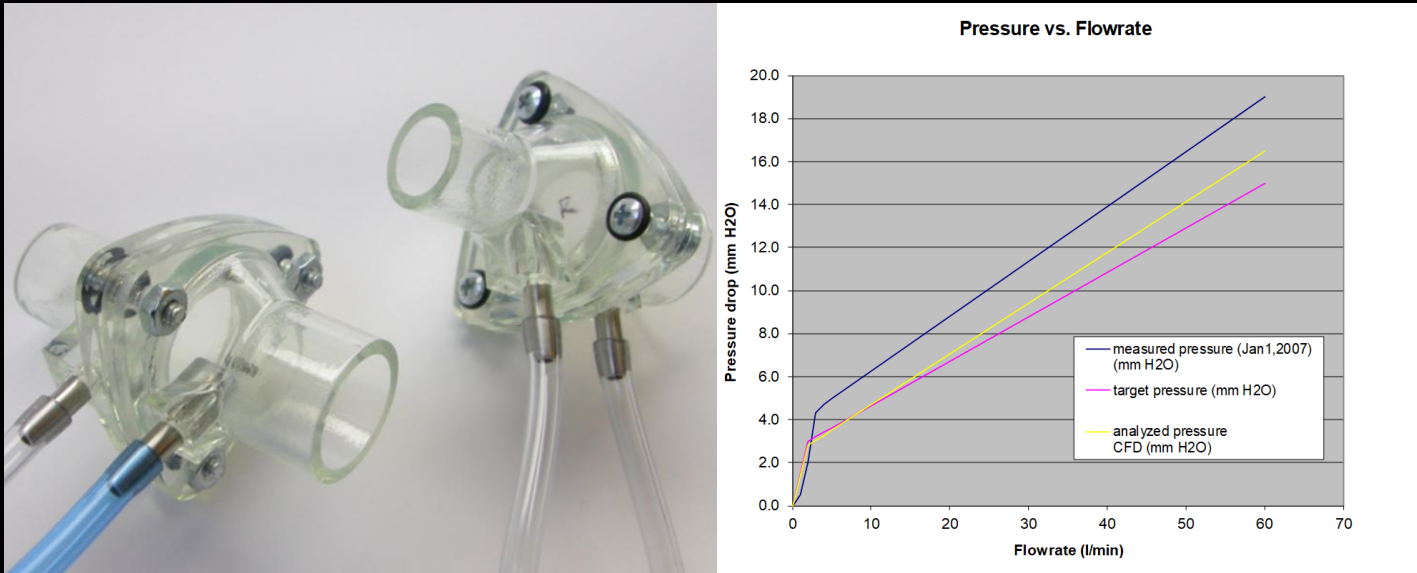
An inexpensive spring-loaded valve could be a flapper valve.



- Thin polyester flapper
- Bending under pressure serves as spring
- Equate theoretical restriction area with the gap between flapper profile and inner tunnel.
- Tune the bending of the flapper web with FEA and virtually validate with CFD.

02

Flow Trigger Adapter



Result

Iterative CAD modeling and FEA & CFD.

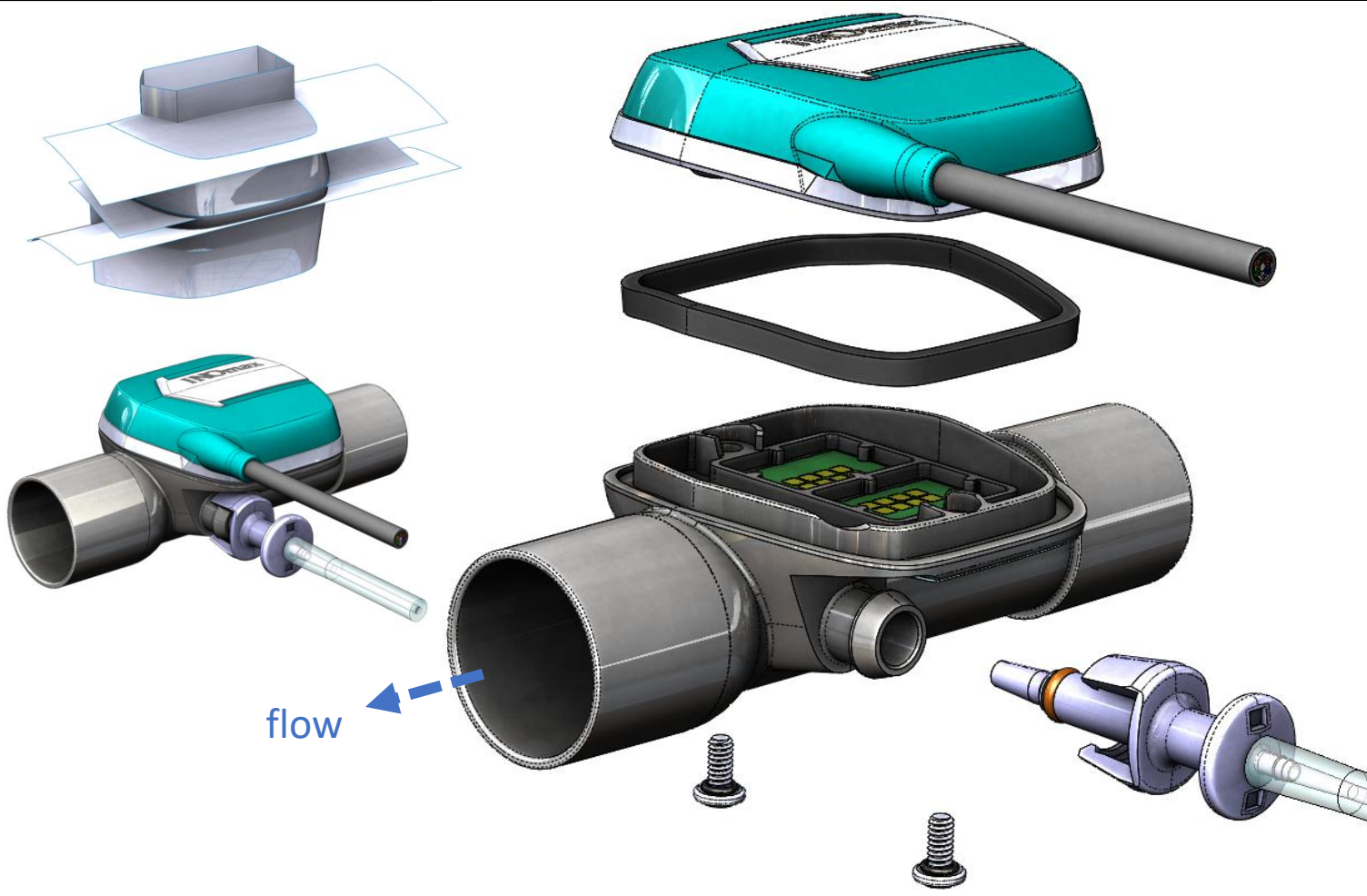
Balance preferred thickness and dimensions along with DFM plastic molded features that could be made without undercuts.



- Proof of concept 3D printed design
- Benchtop pressure measurement validation
- Plastic part design – 3pc. sonic welded
- DFM/A
- Engineering drawings
- Release for tooling
- 6 weeks total development

03

Injector Module



Aside...

And how do we introduce the therapy gas to the breathing circuit?

Here is the drug delivery module for this same breathing circuit.

- Surface master modeling
- Embedded sensors
- DFM/A
- Sealed design affords sterilization reuse
- TPE over-mold plastic part design

04

“Evolve” Pneumatic Infusion Pump



2nd aside...

...And here is the controller for this delivery system platform known as “The Evolve”.

Designed an early prototype demonstrator model, including the high-pressure valve piercing mechanism.

- Over-center canister valve mechanism
- Manifold plumbing design
- DFM/A
- GD&T
- Tolerance stack-up analysis
- Form study CAD model

05

Zip Clean

 Diversey



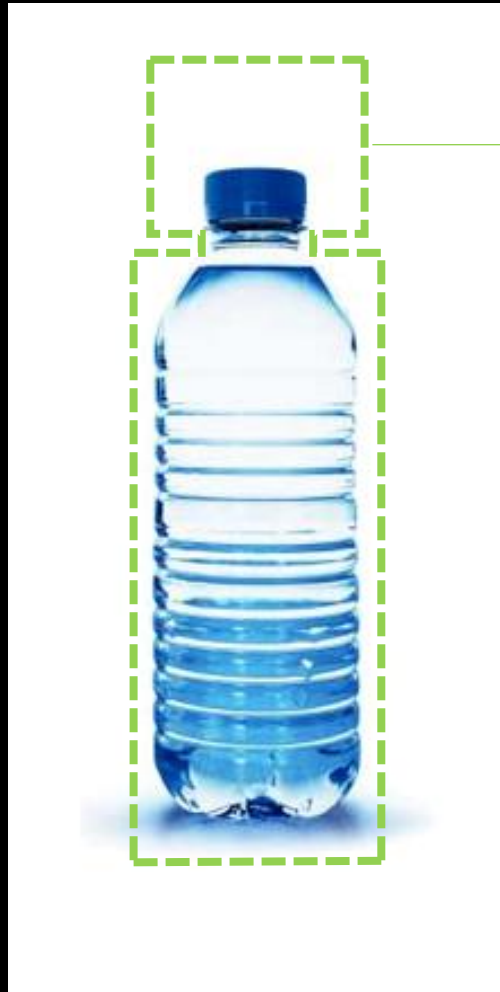
Problem / Challenge

Plastic bottle factory air conveyance systems require awkward, time-consuming maintenance cleaning.

The Diversey Co. supplies cleaning solutions to bottle factories and requested if a tool or device could be designed to make cleaning faster and more convenient for their customers.

05

Zip Clean



Working
envelope

Action

Rather than a tool to assist manual cleaning – perhaps a leap in efficiency is possible with an autonomous solution.

- How can a cleaning swab be automatically moved through the airveyor track?
- Mechanical design
- Plastics and double shot elastomer wheel/tire
- Drivetrain analysis
- DFM/A

05

Zip Clean



Result

Solution – an autonomous track swabbing robot.

Motorized device fits in the width of the track and swabs as it travels. Spring loaded arms pushes drive against the track ceiling. Failsafe recovery hook and disposable swabs are a consumables revenue stream.

- Improves cleaning time by factor of 200
- Dramatically reduces injury risk
- ID press recognition

core77
design magazine & resource

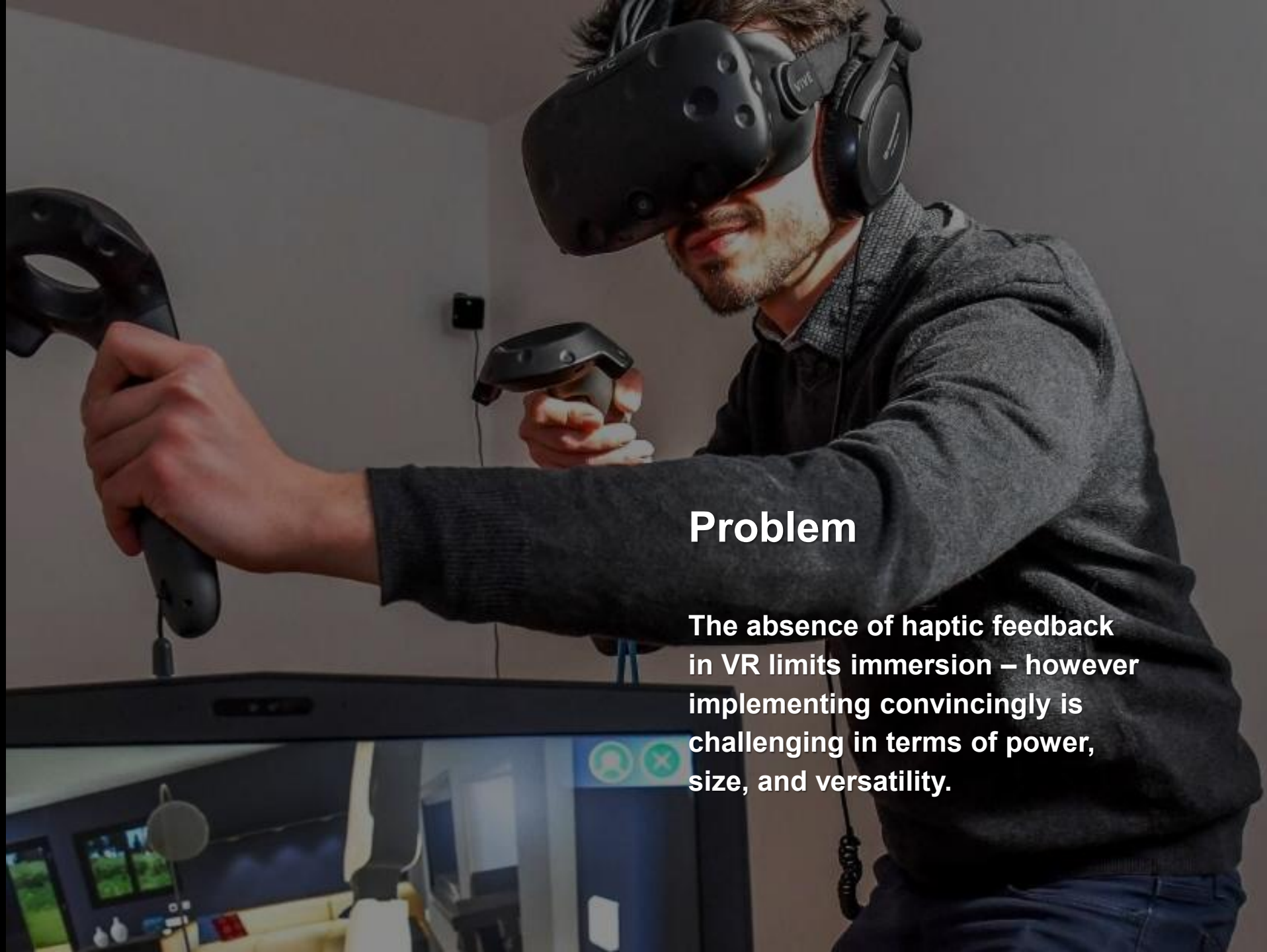
An Obscure ID Firm Grows Through the Recession

Posted by hipetomp | 5 Jun 2012 | Comments (3)



06

Haptic Feedback VR Controller

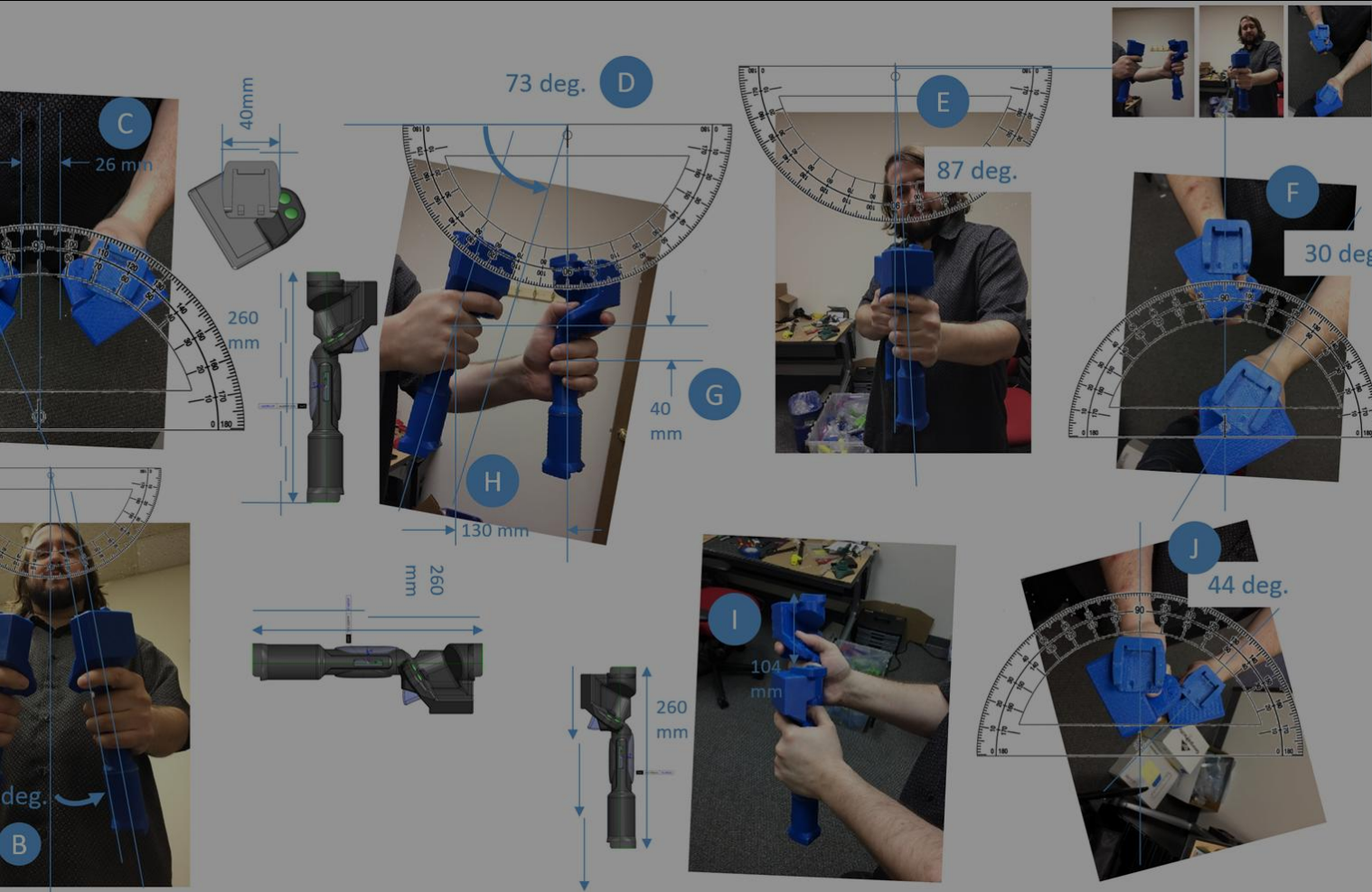


Problem

The absence of haptic feedback in VR limits immersion – however implementing convincingly is challenging in terms of power, size, and versatility.

06

Haptic Feedback VR Controller



Action

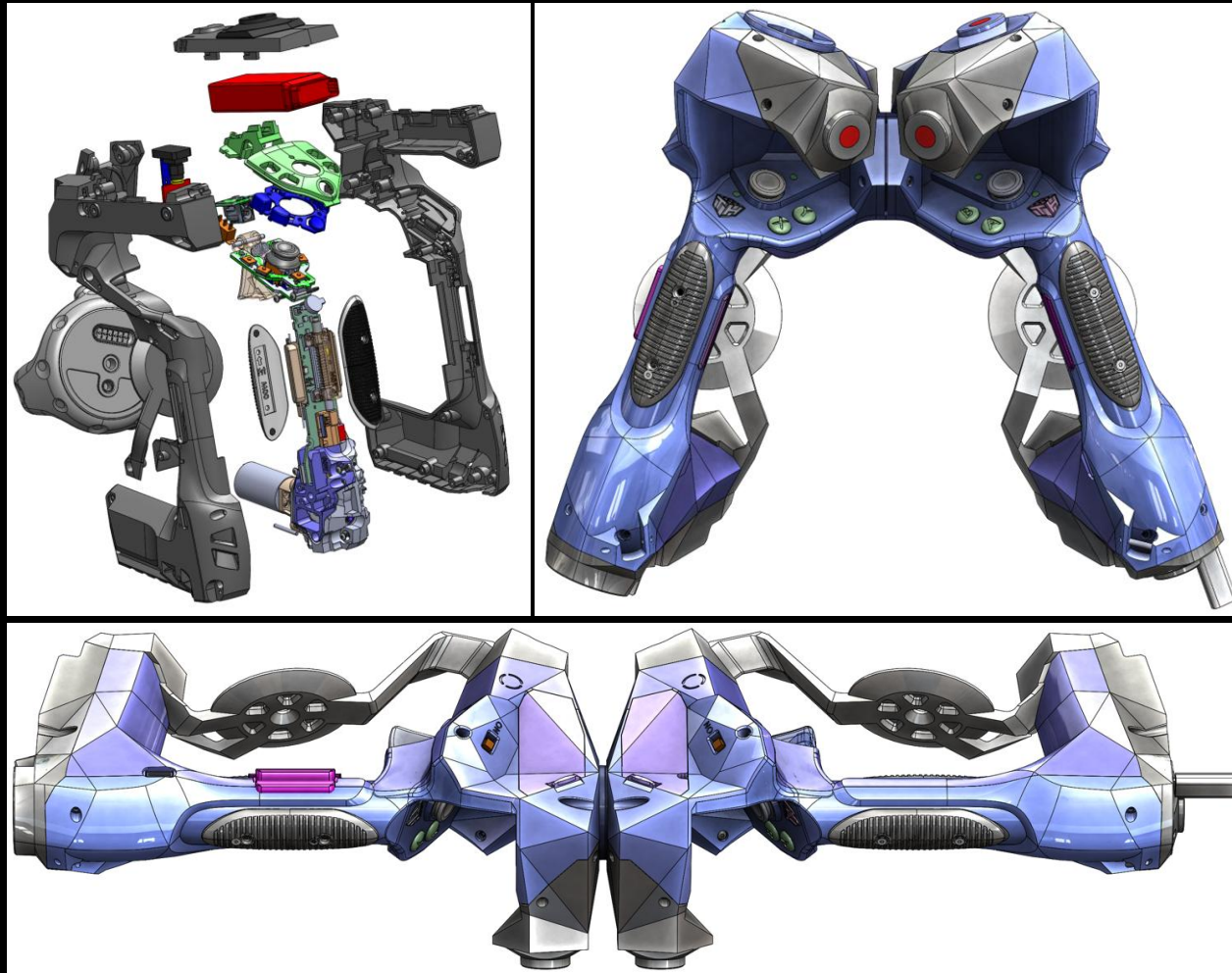
Fit 10 lbs. of smart powered tech in 1 lbs. box.

Human factors analysis of generic posture angles.

- Mechanical design
- Plastics and double shot elastomer design
- Drivetrain analysis
- DFM/A

06

Haptic Feedback VR Controller



Result

Affords both Vive and Oculus tracking.
Motorized sliding double shot molded tactors emulate inertial forces.

Handed for magnetic male/female interface
coupled postures: control yoke, pole arm,
machine pistol, etc.

07

UAFX



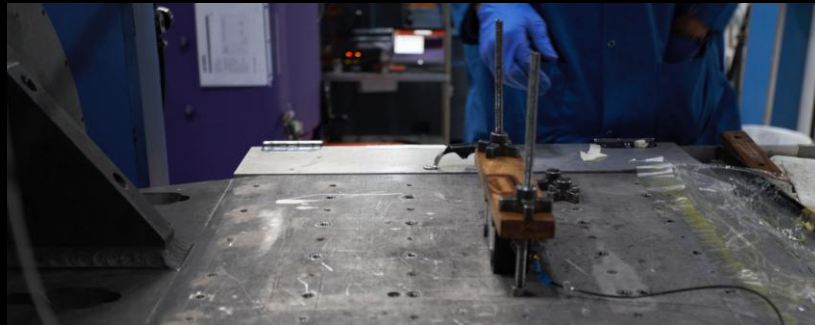
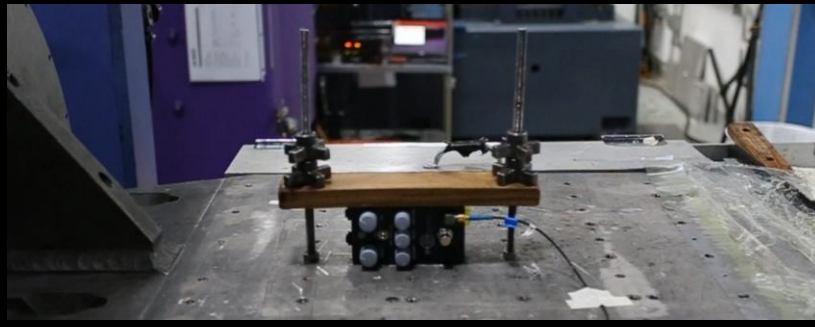
Problem

Foot pedal hardware product validation prior to device launch warrants testing typical use and abuse cases.

Namely drop, shock, and vibration testing.

07

UAFX Knobs Validation Testing



Action

Vibration test protocol:

Ascending & descending 5-500 Hz, cycle sweep testing (per axis) over a period of several hours.

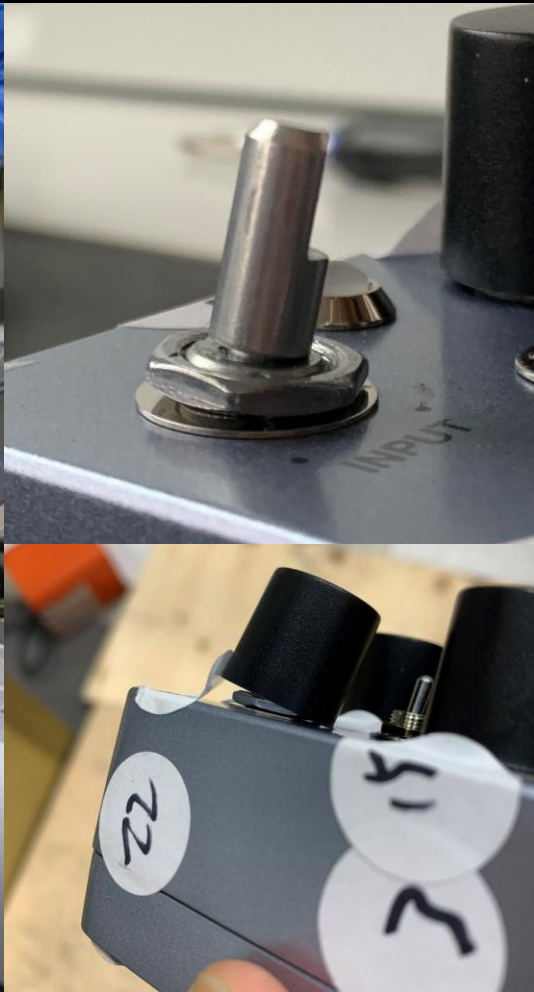
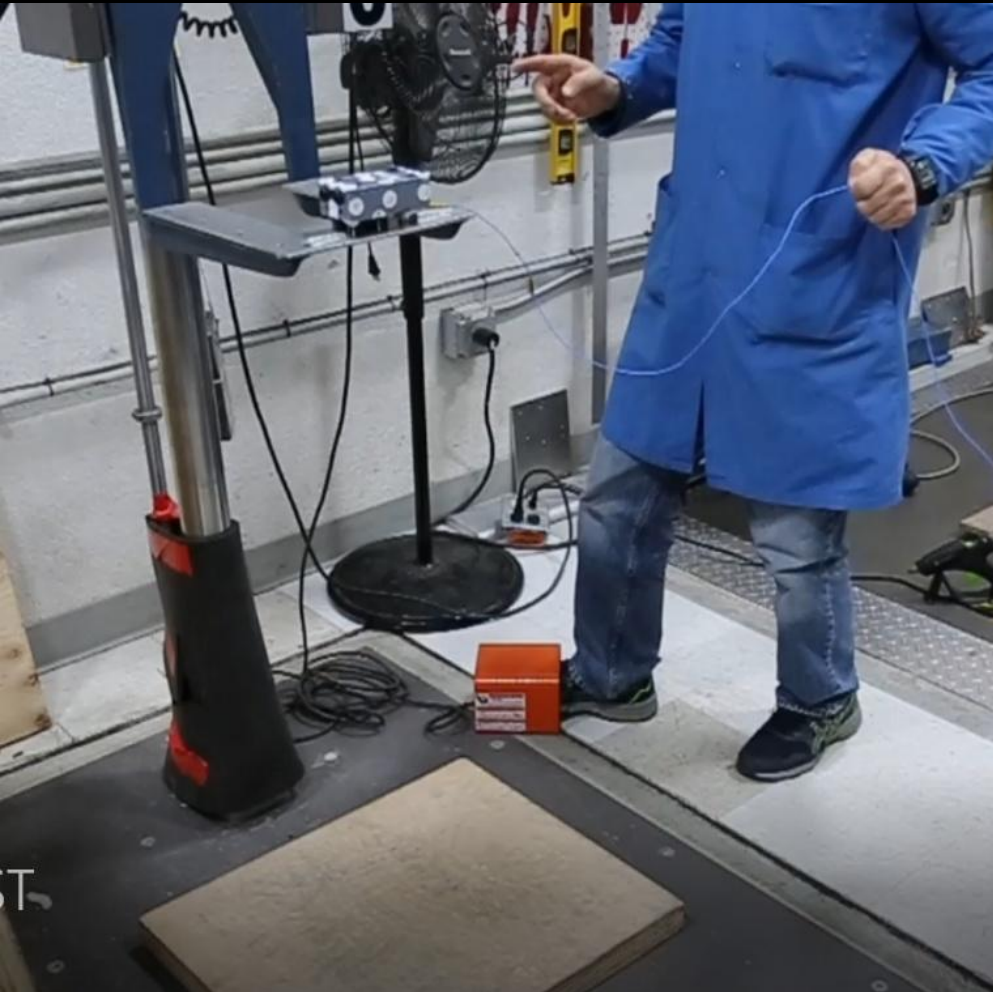
Drop test protocol:

26 orientation drop per MIL-STD-810G

- Coordinate with hired 3rd party test lab
- Participate / verify test setup and procedure
- Observe effect on established risk criteria:
 - Fastener loosening
 - Component separation & failure
- Document and report

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07

UAFX Knobs Validation Testing



Result

Vibration testing validated fastener torque specs and confirmed additional thread locking to be unnecessary.

Drop testing revealed excessive vulnerability of the top row large knob that warranted the addition of an inexpensive custom flanged nut to serve as a brace.

- Use evidence to benchmark and refine the device durability prior to mass production.
- Optimize quality and customer confidence.
- Improved durability 400%

07

UAFX Knobs Validation Testing



Problem

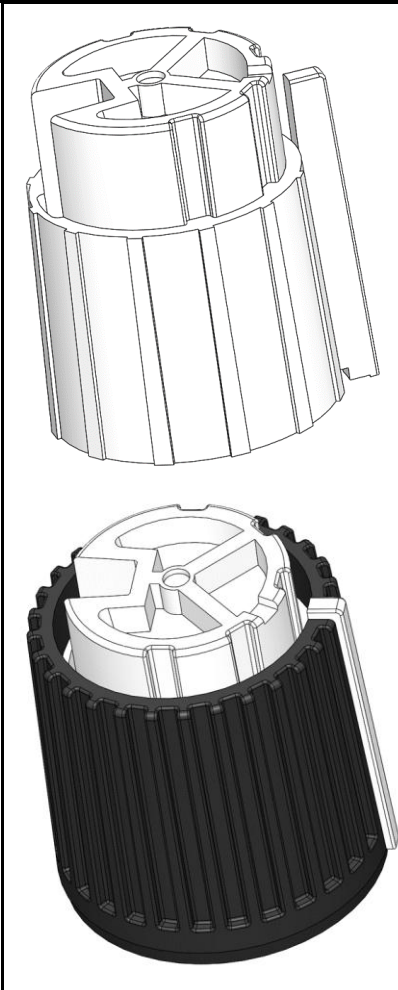
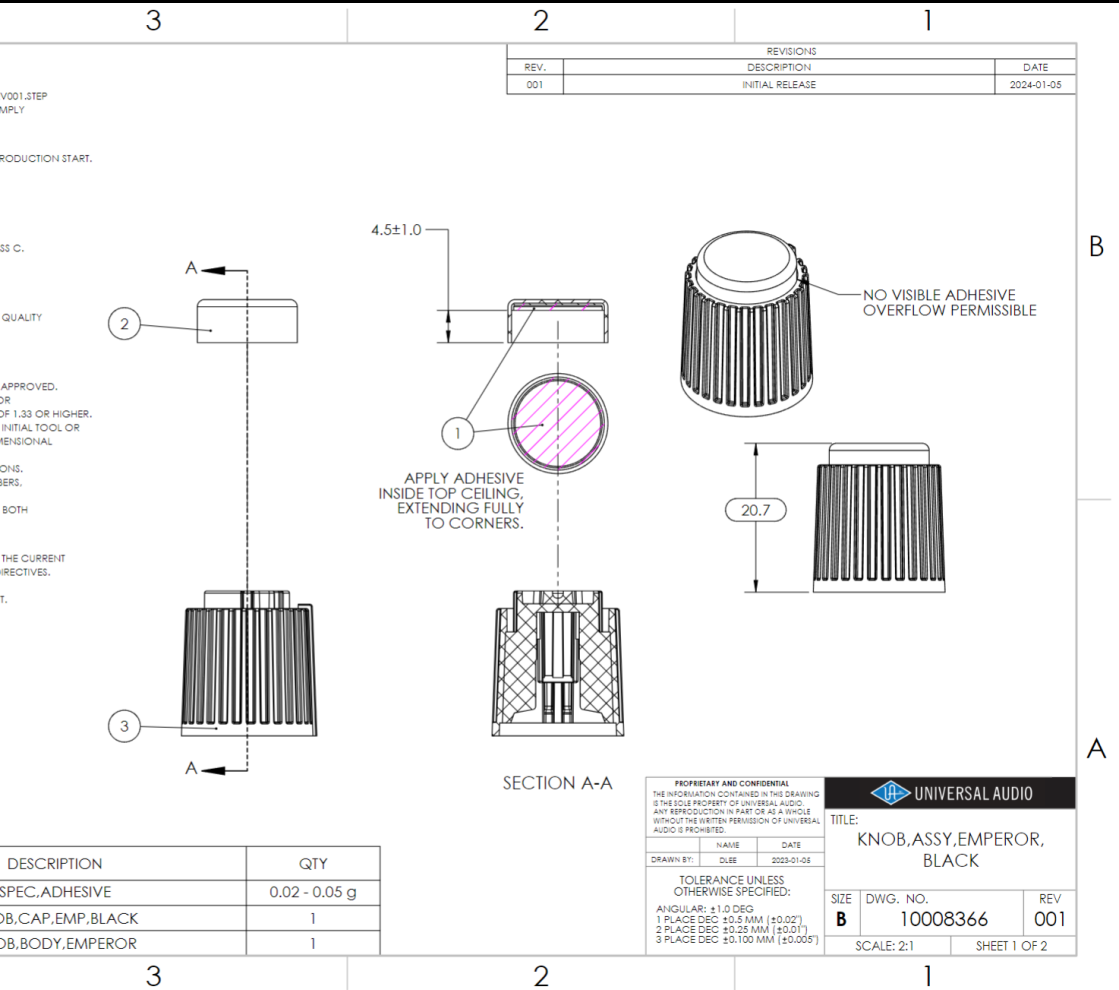
Audio gear snobs are notoriously particular to knob design and feel. As a result, style, shape, and appearance will unpredictably vary as a function of device type and trends.

But product development time is a burden if we need unique design every time.

- Design development - value optimization

07

UAFX Knobs Validation Testing



Action

Exploit previous learnings to reduce plastic part design time and streamline development

Standardize the crush rib to shaft shape. Design the interface geometry once and reuse.

- Double shot plastic part design
- Nurture supplier DFM relationships
- Exploit CAD – insert part / master modeling

07

UAFX Knobs Validation Testing



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Problem

Golfers have addictive personalities...

Originating from a mix of collector identity and the urge to tinker – frequently resulting in an excess of stuff.

Challenge is to:

- Educate golfers in fitting
- Maintain the joy of tinkering
- Minimize the shame of waste

Patent Application Publication Sep. 25, 2025 Sheet 7 of 16 US 2025/0295960 A1

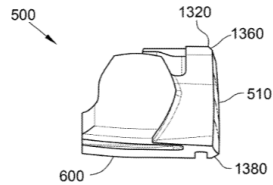


FIG. 17

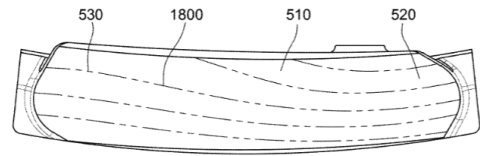


FIG. 18

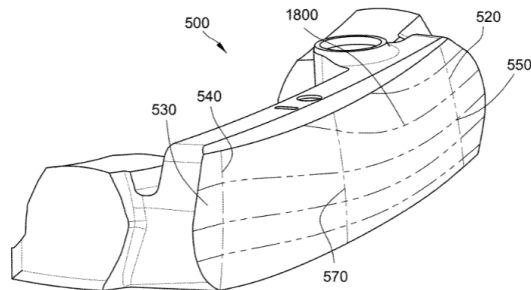


FIG. 19



US 20250229143A1

(19) **United States**
 (12) **Patent Application Publication** (10) **Pub. No.:** US 2025/0229143 A1
Lee (43) **Pub. Date:** Jul. 17, 2025

(54) **ADJUSTABLE GOLF CLUB HOSEL AND SHAFT SYSTEM** (52) **U.S. CL.**
 CPC *A63B 53/025* (2020.08); *A63B 53/026* (2020.08)

(71) Applicant: **Ryynstal, LLC**, Prosper, TX (US)

(72) Inventor: **Daniel J. Lee**, Prosper, TX (US)

(21) Appl. No.: **19/172,388**

(22) Filed: **Apr. 7, 2025**

Related U.S. Application Data

(63) Continuation of application No. PCT/US2023/032708, filed on Sep. 14, 2023.

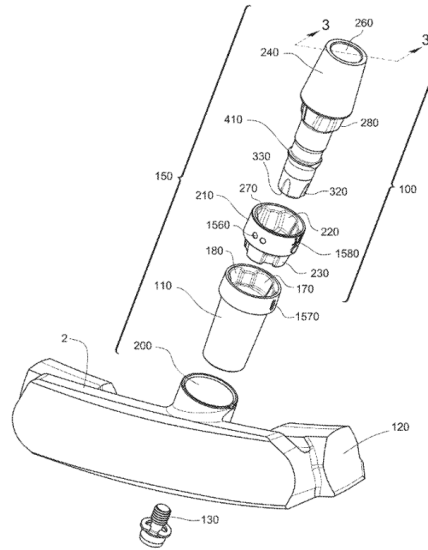
(60) Provisional application No. 63/416,098, filed on Oct. 14, 2022.

Publication Classification

(51) **Int. Cl.**
A63B 53/02 (2015.01)

(57) **ABSTRACT**

A fixation assembly is provided for fixing a golf club shaft to a golf club head. The assembly includes a first bore integrated into the golf club head, the first bore having a first orientation fixation feature and a first axis of symmetry. The assembly also includes an adapter ring having an inner second bore and a second orientation fixation feature for mating with the first orientation fixation feature to fix an orientation of the adapter ring relative to the first bore. The second bore has a second axis of symmetry, and when the second orientation fixation feature is mated with the first orientation fixation feature, the first axis of symmetry is not colinear or parallel with the second axis of symmetry. Also provided is a system for fixing a golf club shaft to a golf club head.



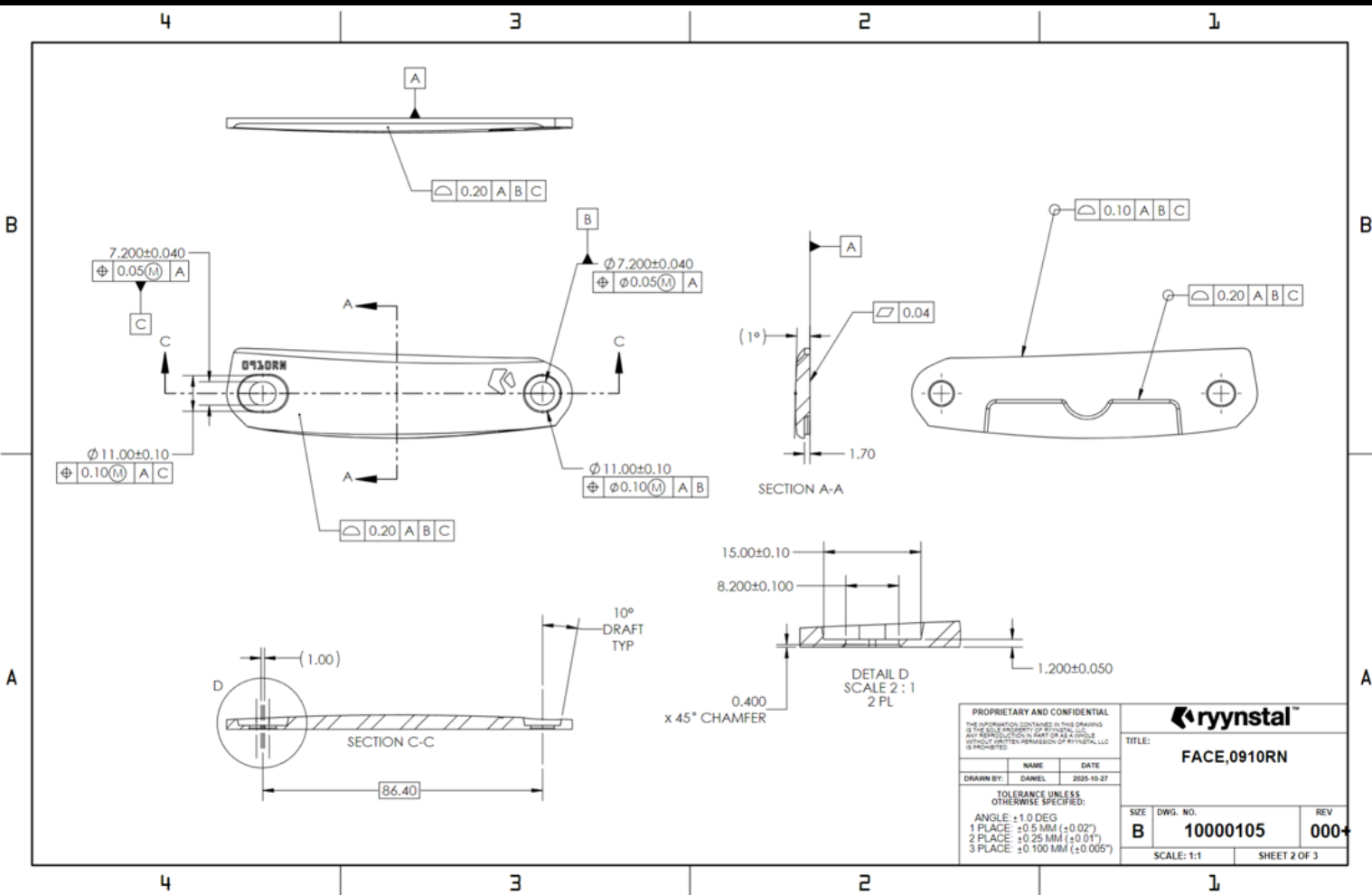
Action

Consider a modular club platform that allows convenient and economical part alteration to change all primary fit characteristics.

- Loft
- Lie
- Length
- Mass
- Balance
- Face angle

08

Ryynstal – Modular Golf Platform



Action

Consider a modular club platform that allows convenient and economical part alteration to change all primary fit characteristics.

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08

Ryynstal – Modular Golf Platform



Result

Currently play testing alpha prototype & developing and collecting manufacturing quotes from candidate suppliers.

...work in progress

Thank you

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<HTTPS://RYYNSTAL.COM/PORTFOLIO/>

