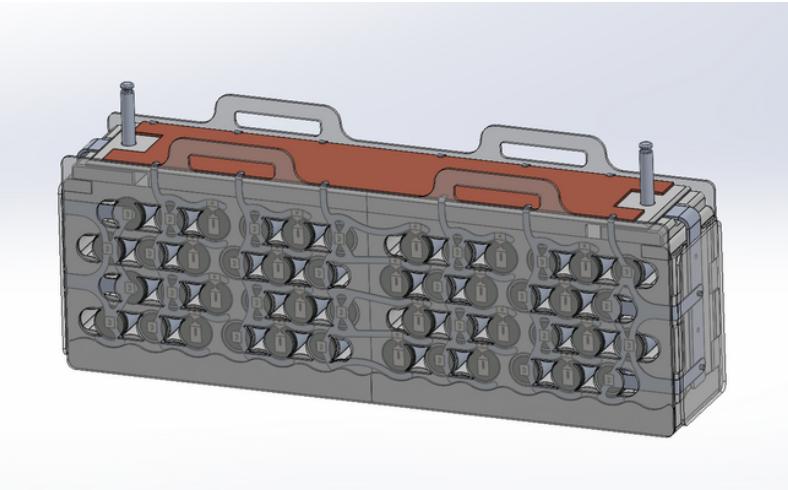
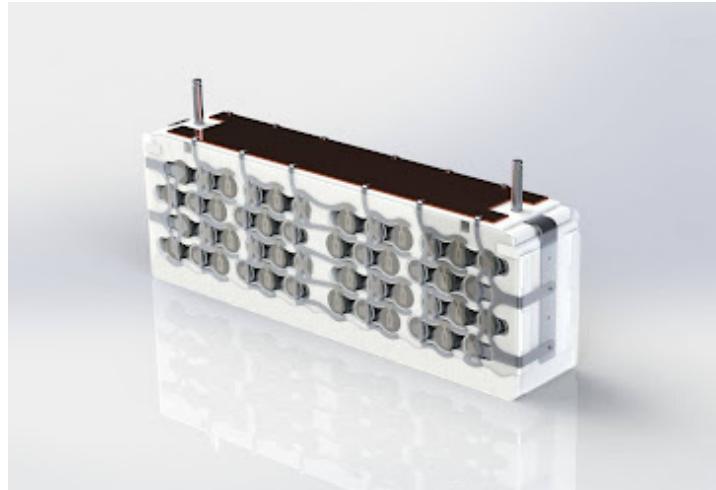


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CUSTOM LI-ION BATTERY PACK FORMULA ELECTRIC AT BERKELEY (2023)



What?

- Designed a ~500V Li-ion fully custom battery pack from scratch.
- Performed **thermal and electrical calculations** and conducted **material research and analysis**.

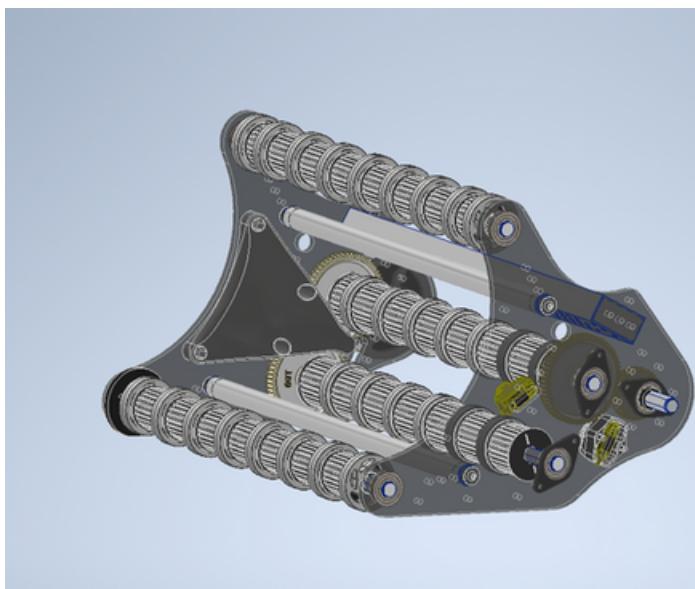
How?

- Created 2D master sketches with **GD&T** applied.
- Used SolidWorks **sheet metal** features for iteration and design.
- Designed to use spot welding or wire bonding for cell connection.

Results

- The design passed multiple design reviews from Tesla and Apple engineers
- The segment is in progress for **live module testing** in the coming months.

BELT-POWERED CONE & CUBE INTAKE FRC 5895 (2023)



What?

- Belt and pulley powered intake to grab, hold, and release small rubber traffic cones and inflated cubes.
- **Sensor implemented** to autonomize intake depth.
- **Anti-jam mechanism** included.

How?

- Designed using **Autodesk Inventor**.
- Conducted **torque calculations** based on prototypes to determine power transmission ratio.
- **Iterated multiple intake designs** and changed belt stack-ups to optimize grip on rubber cones and PVC cubes.

Results

- The intake is robust and **collision resistant**.
- Intake can consistently secure cones and cubes pickups without damaging them.
- Seasonal highest rank of **8th out of 3294 teams** worldwide.

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WINCH-POWERED TELESCOPING CLIMBER FRC 5895 (2022)



What?

- Designed a **passive-extend** **winch-retract** telescoping arm to lift a **~120lbs** robot **5ft** off the ground.
- Climbs at **1.5ft/s** with stall torque of **1117 lbf**

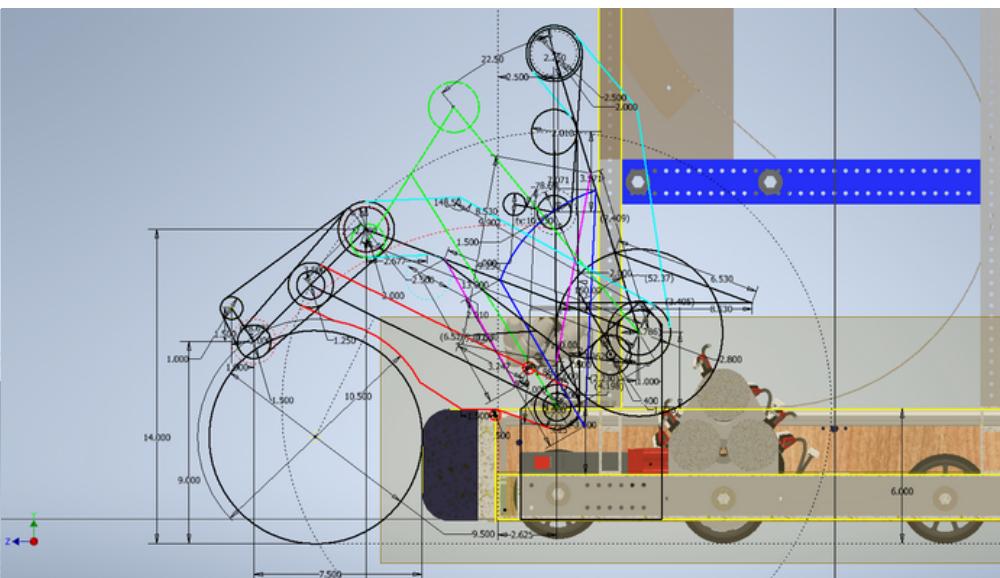
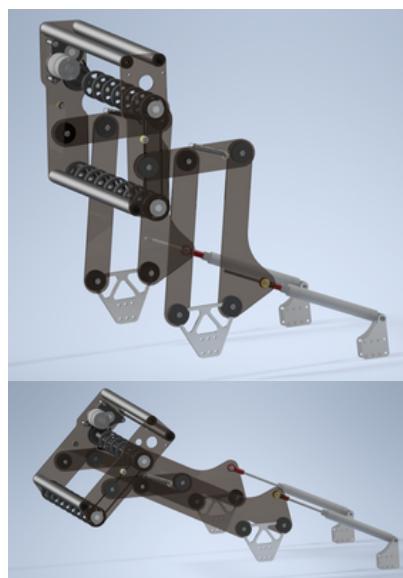
How?

- Designed using **Autodesk Inventor**.
- Conducted **torque calculation** and derived the necessary spool diameter and rope length.
- Parts machined using **router** and **CNC mill**.

Results

- The climber is very robust and **didn't need any repair throughout the season**.
- The telescope is fast and allows the robot to go off the ground in 1 second.

PNEUMATIC & BELT POWERED BALL INTAKE FRC 5895 (2022)



What?

- Parallel four-bar roller intake** for picking up $9\frac{1}{2}$ in oversized tennis ball.
- Powered using **12.2:1 gear reduction** with **20DP gears** and **5mm HTD belt**.
- Activated by **4" stroke cylinders**.

How?

- Designed using **Autodesk Inventor**.
- Drew **2D sketch** to illustrate the **motion path of the parallel four-bar** to ensure clearance and packaging.
- Added springs to make intake compliant so it's **collision resistant** (rotates & retracts when colliding with wall or robots).

Results

- The mechanism can **consistently and reliably pick up balls**.
- The intake transitions smoothly into the indexer.
- The intake is easy to replace when damaged.

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PNEUMATIC-POWERED TELESCOPING CLIMBER FRC 5895 (2020)



What?

- Telescoping arm powered by **22" double-acting cylinder**.
- The telescoping mechanism generates **~170lbs** of force to lift a **~120lbs** robot **5ft off the ground**.
- Climber stays in rest position until **gas shocks** passively activate it.

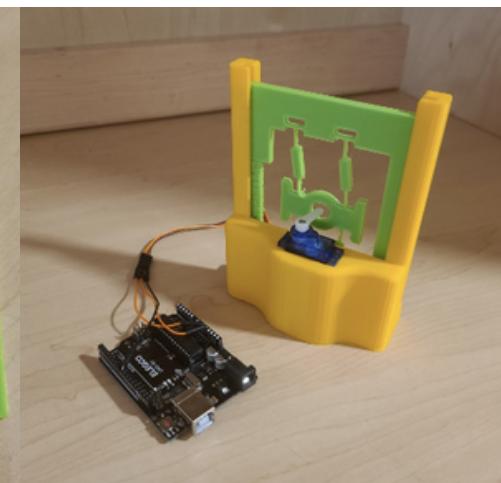
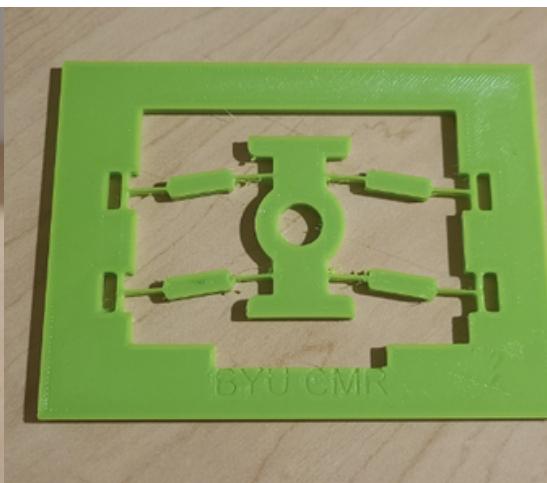
How?

- Designed using **Autodesk Inventor**.
- Created force diagram to determine the minimum force needed for both gas shocks and pneumatic cylinders.
- Parts machined using **router** and **CNC mill**.

Results

- It is able to **consistently lift the robot off the ground**.
- The robot is able to climb when the power cuts off at the end of the match because it is pneumatically activated.

FATIGUE TEST ON COMPLIANT MECHANISM INDEPENDENT R&D (2022)



What?

- Conducted research on **material strength of compliant mechanism** with common 3D printed plastics.
- Designed a novel way to conduct **small-scale fatigue test** with easily accessible components.

How?

- Designed fatigue tester using **Arduino** and **Autodesk Inventor**.
- Planned and carried out **experiment, data collection, data analysis, and paper writing**.

Results

- The research was **nominated for publication** in the Pioneer Research Journal, an extremely selective academic journal for high school students.

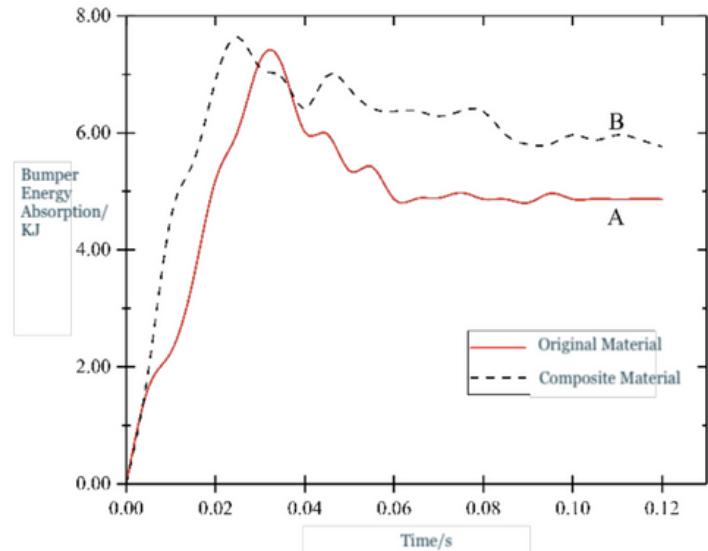
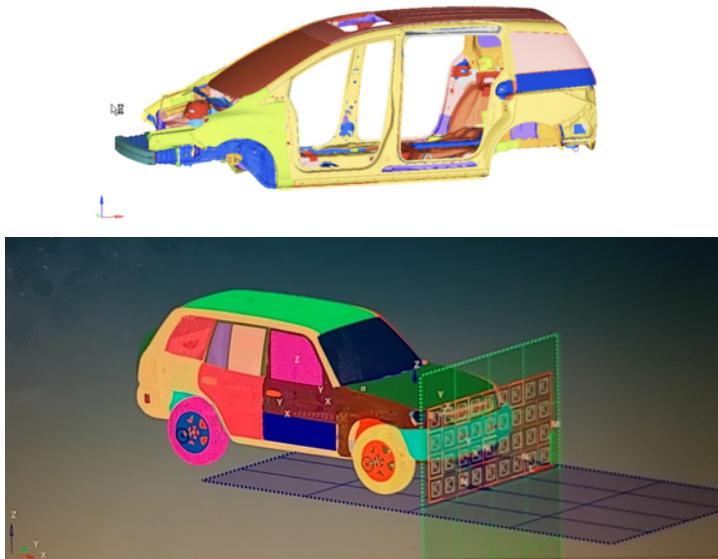
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100% FRONTAL COLLISION FORCE ANALYSIS

INDEPENDENT R&D (2022)



What?

- Conducted **force analysis** on 100% frontal collision of standard SUV intending to improve safety during vehicle crashes.
- Conducted **Finite Element Analysis (FEA)** on a whole-car model with different bumper materials.

How?

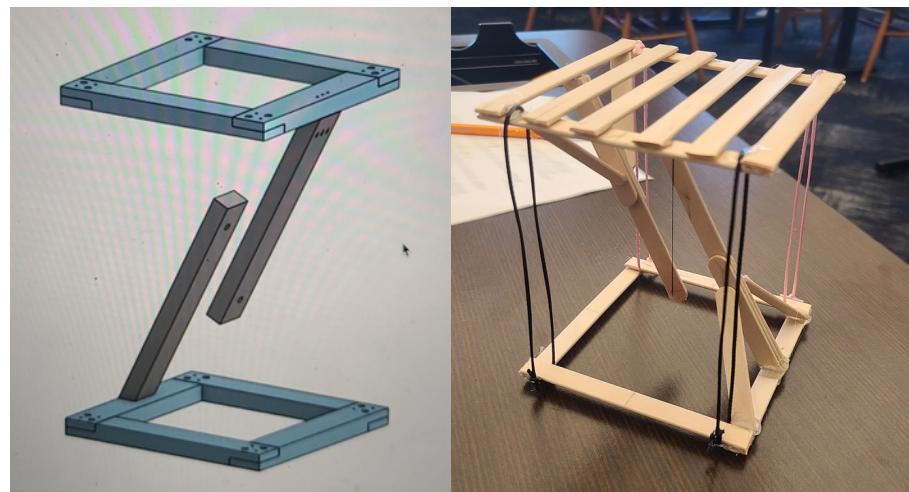
- Conducted FEA through **Altair HyperWorks** and **HyperMesh**, and analyzed result using **HyperGraph** and **HyperView**.
- Carried out research on bumper materials to explore potential substitutes for aluminum alloys.

Results

- Concluded that replacing aluminum alloy with composite carbon fiber will **increase vehicle's factor of safety** during collisions by **increasing force absorbed by material deformation**.

OTHER FUN PROJECTS

TENSEGRITY TABLE (2022)



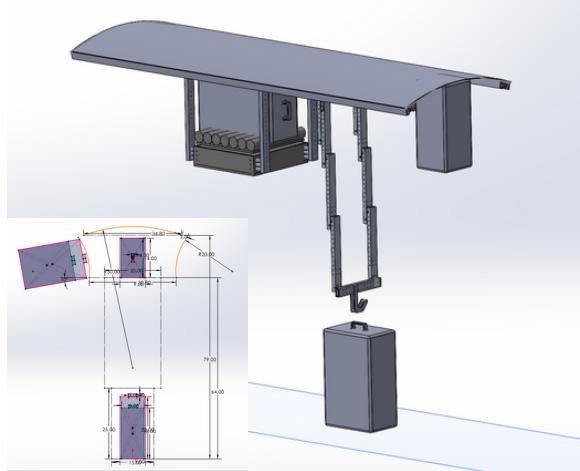
What?

- Designed a **miniature tensegrity table** that is supported purely by the **tensile force of strings**.

How?

- Designed using **Onshape**.
- Modeled with intention to manufacture with wood, but resorted to a miniature design due to time constraints.

AUTOMATED LUGGAGE STORER (2023)



What?

- Designed an automatic **luggage storer** in **the aircraft aisle** to store luggage into the overhead bin in an 24 hours CADathon challenge. Designed using **SolidWorks**.