



Underwater Sorting Collection Vacuum

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Senior Design Team 41 || University of Colorado Boulder || 2021 - 2022

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Mechanical Engineering

Motivation



- 95% reduction in California kelp density, with other places to follow
- 10,000% increase in purple sea urchin populations
- Kelp sequesters 20x more CO₂ per acre than trees do
- Home to thousands of species

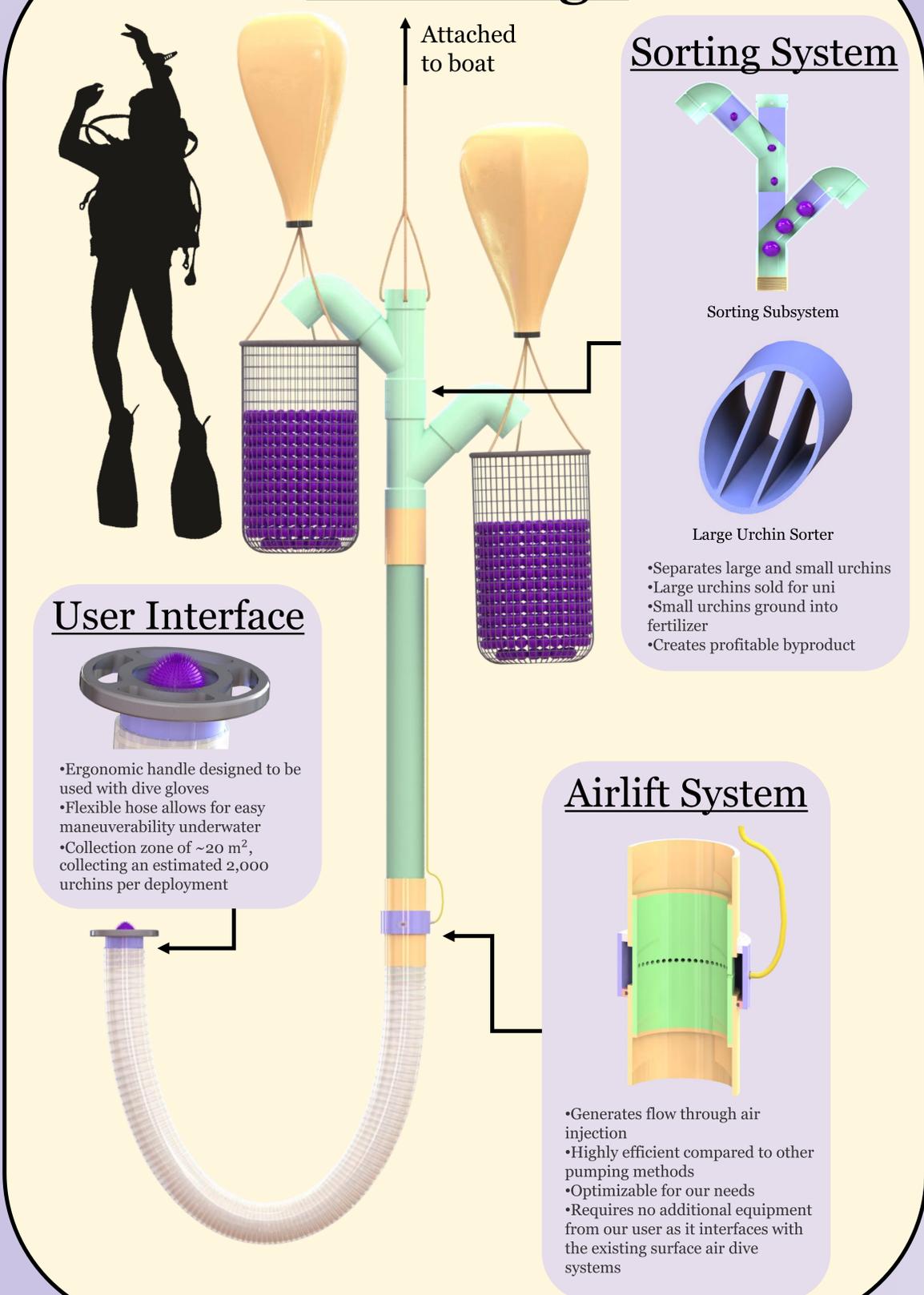
Design Goals

- User friendly -- intuitive, ergonomic, transportable
- Non damaging to the ecosystem
- Durable and doesn't corrode in salt water
- Modular and modifiable
- Sorts urchins into multiple sizes

Manufacturing

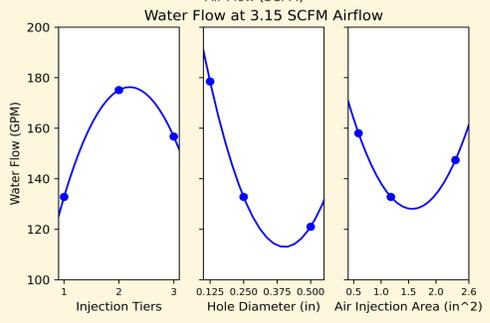
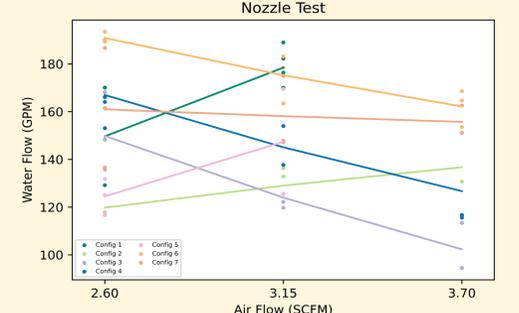
- Majority of components made from PVC to be easy to acquire and not degrade in high salinity conditions
- Designed remaining components such as the sorting inserts, handle, and nozzle seal rings for plastic injection molding configurations
- Solvent welded PVC components

Our Design



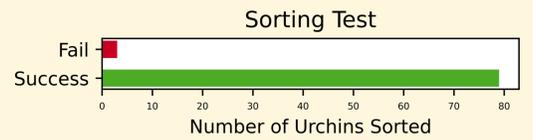
Testing

Nozzle Test



- Measured water flow rate through system as function of input air flow rate for seven nozzles
- Varied hole size, input area, and number of rows independently for nozzles

Sorting Test



- Successfully sorted 96% of test urchins

Pressure Loss With Subsystem Addition

- Acceptable according to Darcy-Weisbach equation
- 5.28% flow rate decrease

Results

- Fully functioning prototype, met or exceeded all design goals
- Won 4th place in NVC climate competition, featured on PHYS ORG and Department Website
- Interest from The Bay Foundation and Oregon Kelp Alliance

