# Aerobics Workout Device

Aerobics R' Us

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# Scenario

Our Client needs a device to help complete various aerobic exercise such  as push-ups, planks, and mountain climber

# Existing Solution

- Not good for exercises
- No shoulder stability

- Can’t help with ΔL
- Long to setup/take off

- Very expensive
- Bulky to wear

## Problem Statement

Our client has a need for a compact and light device to simulate a locking motion in his left elbow while ensuring proper support and assistance under continuous load, throughout symmetrical and static movements.

# Prioritized Needs

- Support the user
- Portable and light
- Controllable
- Self locking feature
- Assist the user in completing symmetrical exercises

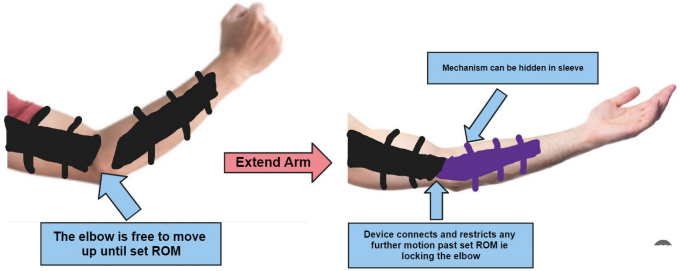
# Design Criteria

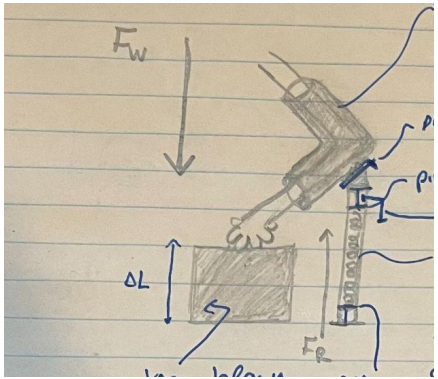
- Convert Prioritized Needs into Design Criteria
- Use this criteria to create potential solutions to the problem

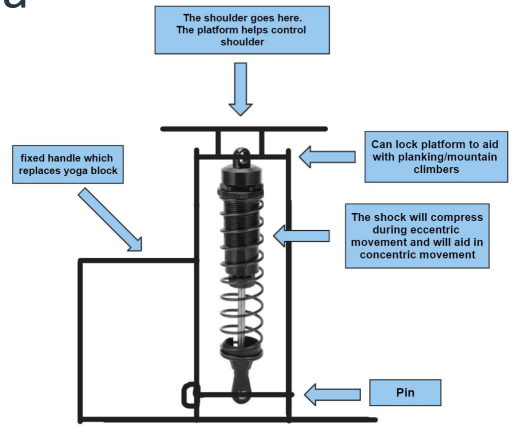
| Interpreted Need | Design Criteria |
|---|---|
| The device is able to lock in place of the elbow | - The device manually locks<br>- The device is rigid enough to support weight |
| The device is portable and light | - Maximum Device weight/size (lbs) |
| The device is easily controllable | - Simple design usage<br>- User Friendly<br>- Controllability on exercise movements |
| The device can aide the users in completing symmetrical exercises | - Proper shoulder stability<br>- Support for eccentric and concentric movements |
| The device can control and stabilize the shoulder | - Device ensures proper exercise form<br>- Can support appropriate load (lbs) |

# Possible Concepts

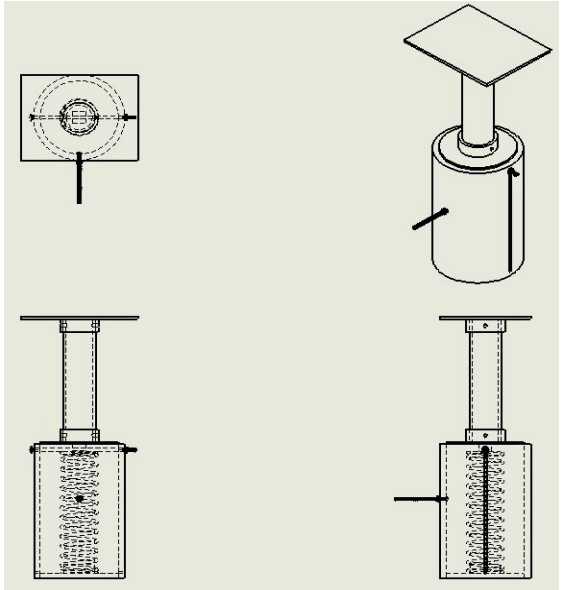
- Initial brainstorming phase; All ideas are welcome
- Analyze concepts against Target Specifications
- Potentially combine the positives of each idea



# Chosen Concept

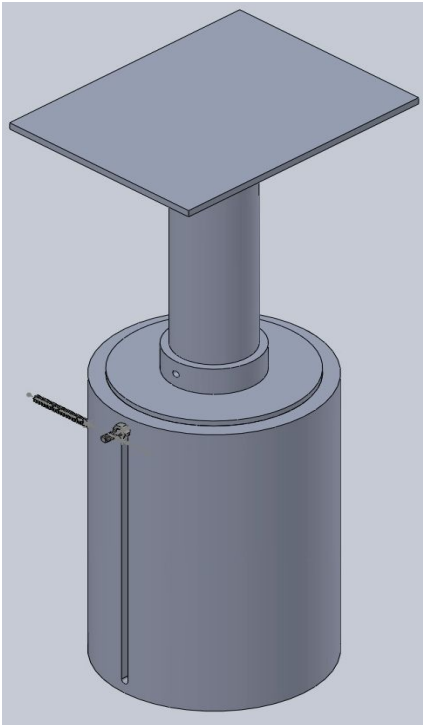


$$F = Kx$$

F = Force Applied to the Spring

K= Spring Coefficient

x= Distance Compressed



# Prototype 1A

**Objective:** Verify custom pipe fitting size/strength

**Fidelity:** Medium

**Type:** Physical/Focused

**Method:** 3D print (0.4/0.6/0.8mm nozzle)

**Assumption**: Test model will perfectly fit in the pipe

# Prototype 1B

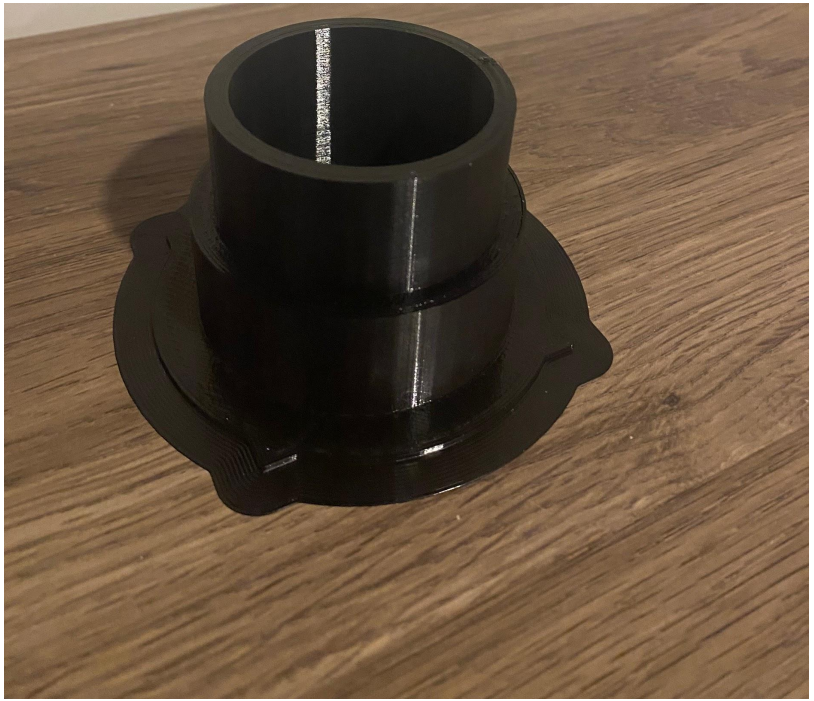
**Objective:** Test strength of custom spring connector

**Fidelity:** Medium

**Type:** Physical/Focused

**Method:** Printed on 0.8mm and 200 lb would be applied

**Assumption:** Test model will support 200 lb weight



# Prototype 2

- **Final Prototype**
- **Objective:** Test all Components Together
- **Fidelity:** High
- **Type:** Physical/Comprehensive
- **Assumption:** Device Works as Planned
- **CEED Resources Required**:
  - Mill for Slots
  - Drill Press for Bolt Holes
  - 3D Printers for custom parts

# Feedback/Decision Made

**Spring**

- The spring that was used for this product was too strong

**Vinyl Wrap**

- Made the platform be more comfortable and soft for the chest/shoulder

**Tipping**

- Build a handle/surface to avoid any tipping

**Pipe Fittings-Spring Connecting**

- Rechanged the fitting due it not having the correct dimension

# Business Model

- **Reverse Razor Blade Model**
  - High upfront cost
  - Low accessory cost

**Accessory Option**

- The spring
  - Customer will request springs based on the condition of their arm/shoulder
- The platform
  - Customization/replacing the cushioning based on customers' preferences/the condition of the platform

# Economics

Clients that would buy our product are clients who suffered arm injuries, physiotherapists, gyms and any client who may have suffered an arm injury.

Estimation of how many clients would buy our product is **326,323**

## 3-year statement

Assuming 2% of clients buy the product in year 1 with 50% increase in year 2 and 3 for a total of 4.5% of 326323 of our total client and that would give a 15,000 units sold within 3 years. 300$ would be charge for each unit.

**Sales: $4 500 000**
**Cost of Goods: $2 250 000** *(Assuming approximately 150$/unit to manufacture)*

**Gross Profit on Sales: $2 250 000**
Operating Expenses:
Marketing Expense: $75 000
Salaries: $630 000 → Assuming 3 employees making $70,000 per years
Overhead: $60 000 →($20,000 per year)
Rent: $72 000 → ($24 000/year)
Equipment: $500 000 → Mills and lathe purchase
Electricity: $150 000 → ($50 000/year)
Depreciation: $135 500 → All machinery would have a depreciation of 10% each year
**Total Operating Expenses: $1 622 500**
Operating Income: $627 500
Income Tax (25%): $156 875
**Net income: $470 625** *(over 3 years)*

# Economics

| Value | Cost (3 years) | Notes |
|---|---|---|
| Material | $ 2 250 000 | Assuming approximately 150$/unit to manufacture |
| Overhead | $ 60000 | $20,000 per year |
| Manufacturing Equipment | $ 500 000 | Mills and lathe purchase |
| Salary | $ 630 000 | Assuming 3 employees making $70,000 per years |
| Marketing | $ 75 000 | $75,000 will go to marketing |
| Rent | $ 72 000 | Expense |
| Electricity | $ 150 000 | Expense |
| Depreciation | $ 135 500 | All machinery would have a depreciation of 10% each year |

To conduct the NPV analysis, we assumed an annual inflation rate of 5%.

**NPV Analysis of Fixed Cost**

NPV=FV(1+i)n

NPV=1 431 247.19$

**NPV Analysis of Income**

NPV = Income - Cost of goods

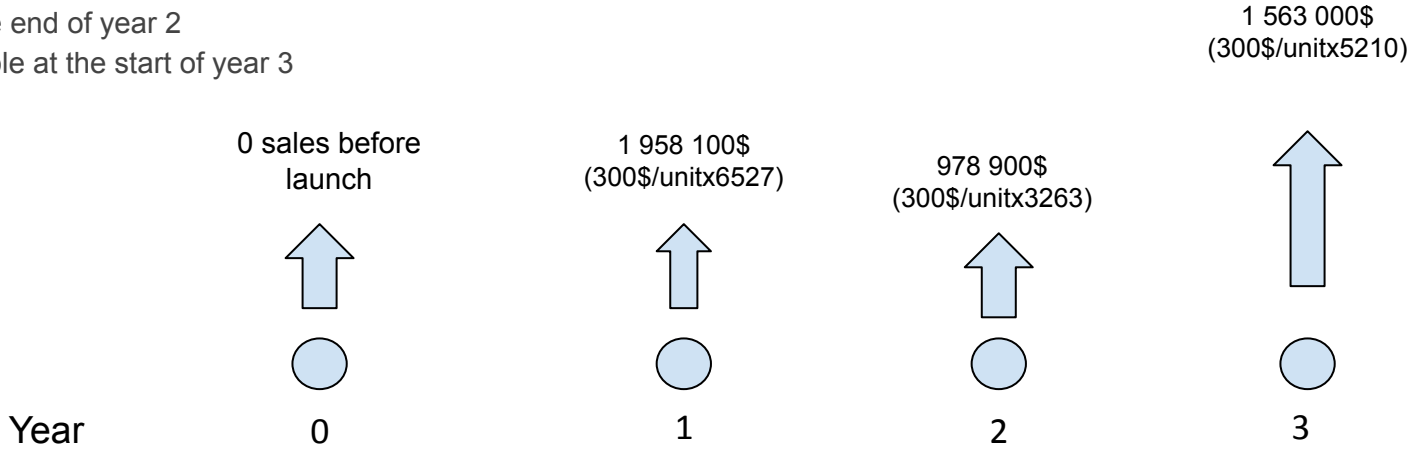
NPV= 1 881 702$

**Break-Even Point**

BEP=Fixed Cost Income - Cost of Goods=1 431 247.19300-150=9541.65 units ≈ 9542 units

9790 units will be sold at the end of year 2

Our business will be profitable at the start of year 3



# Room for Improvement

- Custom Spring for improved Compression
- Ergonomic Handle for user comfort
- Reduce weight for increased portability