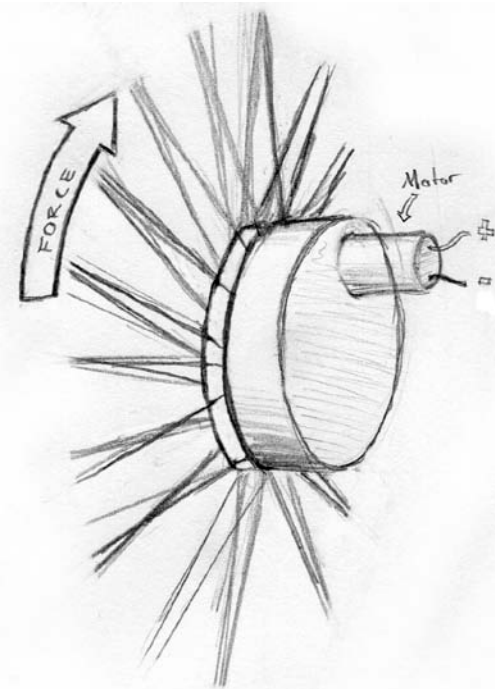
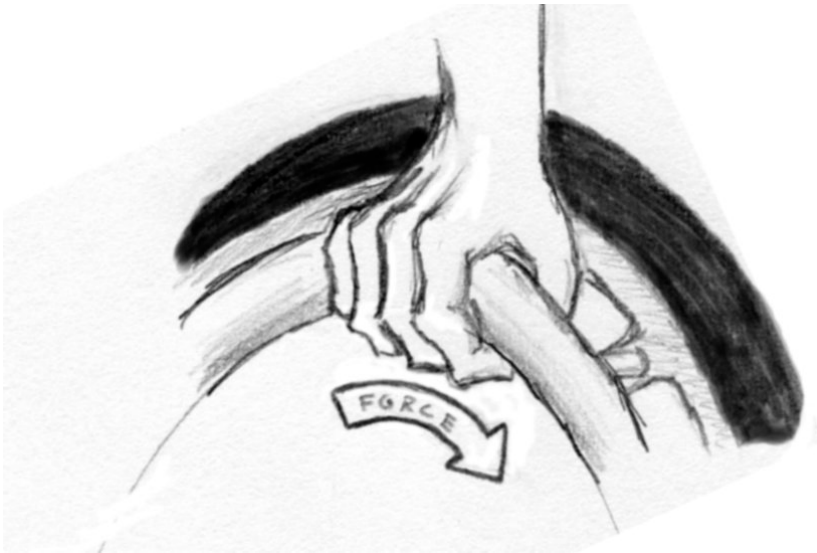


Chair Force One

Mockup Presentation

CF1 is a manual wheelchair that provides power assistance

The hand rims sensors detect user-applied forces...



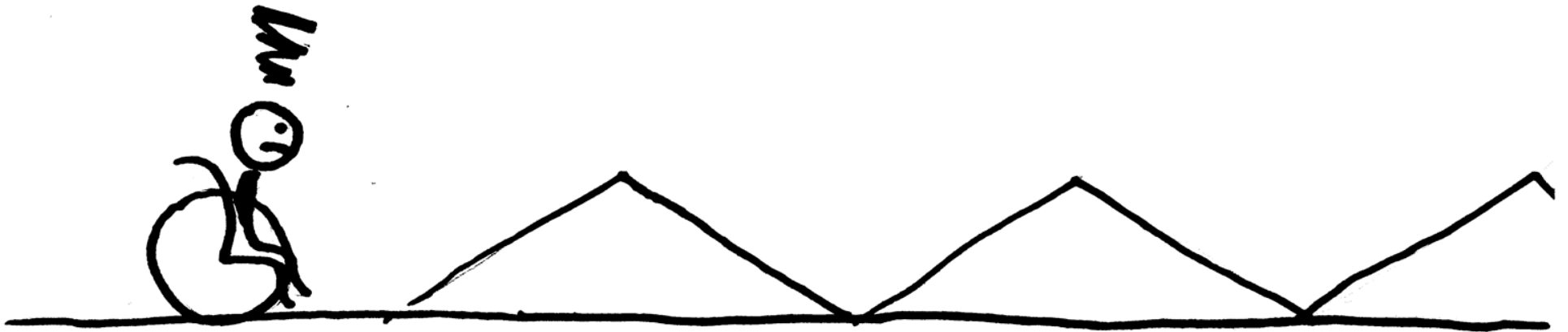
...and send a boost signal to the motorized wheels

Scenario 1



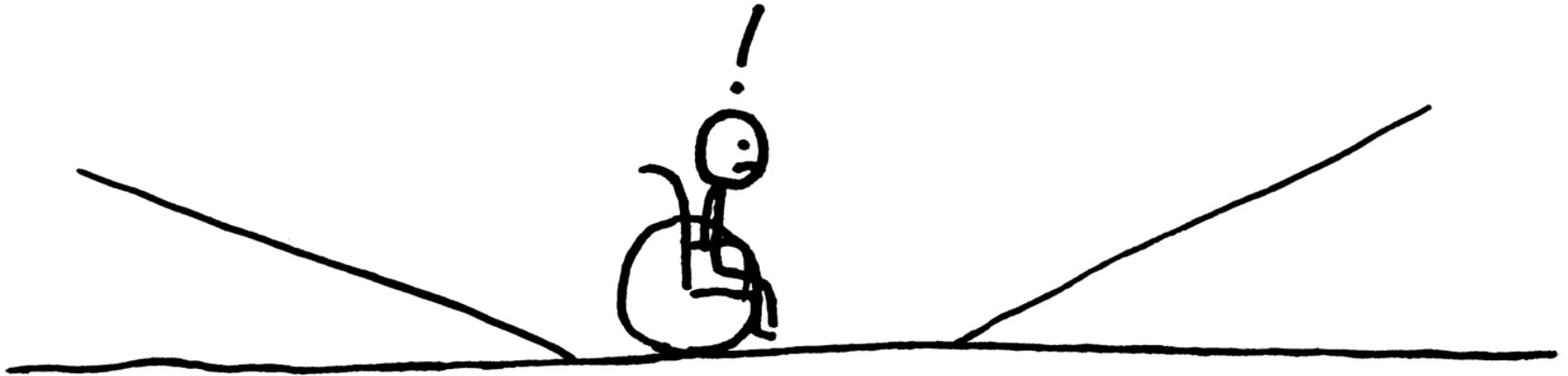
Maria is a new user who needs to build up arm strength

Scenario 2



Atissa becomes fatigued after travelling far every day

Scenario 3



Dave wants to retain the independence of a manual wheelchair, but doesn't have the strength to use one

Scenario 4



Richard worries that he won't be able to apply enough force if his hands slip on the rims

Key Risk

- Can we keep our boost system within user's weight constraints?
 - Determine the **ideal boost assistance and component weights**
 - Identify **motors and batteries** that fall within tested user constraints

User Testing for Ideal Boost

- ADA compliant ramp
- Pulley system applies force on wheelchair
- Blind weight test
- 18 lbs of boost =
4.75 Nm, 24" dia. wheel



User Interviews

- Must be sleek and lightweight
 - Easy to get into a car
 - Boost takes care of the motor and battery weight
- Must be able to negotiate
 - 20+ ramps per day
 - 60 minutes of constant travelling
- Must be easily chargeable

Sizing Motors and Drivetrain

- Benchmark
- Fisher Price 00768 motor
- 181:1 Gearbox
- 1.5 lbs each
- Back-drivable
- 3.8 Amp @ 4.75 Nm



Energy Storage

50 W-h required

60 minutes at 100% duty cycle

	Soft NiMH	Eagle Picher SLA
Model	VH D 10S	CF-12V4.5
Voltage	12	12
Size (ft ³)	0.022	0.45
Energy (W-h)	54	108
Weight (lbs)	3.75	4.63



Weight of System

- 3 lbs – motors and drivetrains
 - + 4 lbs – battery
 - + 1 lb – electronics and housings (est.)
-

8 lbs – total

Product Contract

Customer Need	Product Attributes	Engineering Specifications
Can be lifted into car	Weight	< 10 lbs. additional weight
Sufficient boost for user comfort	Motor torque	4.75 Nm each
Functions for a full day	20 x 12' ramps + 60 min	50 W-h battery
Control safety	Motor controller	Fail-safe off; no false direction triggers
Speed safety	Speed limit	5 mph
Reliable	MTBF	1 year
All-weather	Resistant to water and temperature variations	NEMA 4X, -20 to 110°F
Value	Cost	\$1000 beyond manual chair

We can't wait to show you CF1!



Purple B