



# Alex Jones

Farmhand Automation Portfolio





# FARMHAND AUTOMATION

An Autonomous Platform for Sustainable Agriculture

# Beginnings

In the Spring of 2019, Farmhand Automation was formed with a pre-seed investment to investigate the feasibility of creating a robotics company in New England to serve small to mid-scale farmers. With 1:1 matching funds from the Maine Technology Institute, Farmhand's founder, Alex Jones, has led the boots on the effort in the Southern Maine region, developing a 2,500 square foot test field, meeting with farmers and prototyping our first proof of concept.



## About Alex

Maine Native, 9 years of agriculture and technology experience. Most Recently Head of Product and later Director of Customer Success US/Canada for robotics inventory management systems at Seattle's iUNU. Previously Product Manager for New England's largest online local food procurement and payments platform Forager.com and Product Designer at the University of Maryland Honey Bee Research Lab.



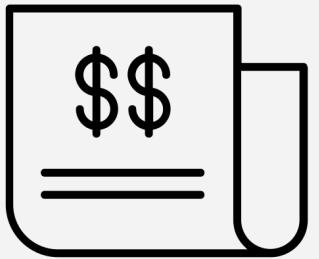
**"Alex, In my farmer meeting last year, and increasingly so this year, concern about labor availability, skill and cost has been driving crop decisions more than any other factor."**

- John Schreiber, Portland Maine's Rosemont Market Produce Manager



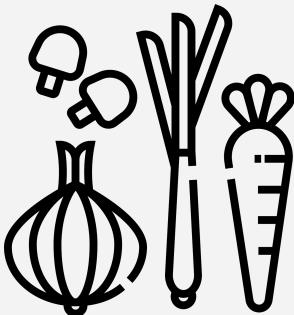
# Needs of the Small Scale Farm

## Challenges and Opportunities



### Costs

Most machinery too expensive to scale operations



### Crops

10 ~ 100 varieties can be grown in a single operation



### Geography

Decentralized across geographic regions with multiple climates



## Our Focus

### The Small Scale Farms

AKA: Millennial Farmers

- 28-35 Years Old
- Market Gardener, Diverse Vegetable Production
- Intensive growing practices using hand tools
- Wanting to scale but don't want commitment of heavy machinery

# Our Focus

## The Mid Scale Farms

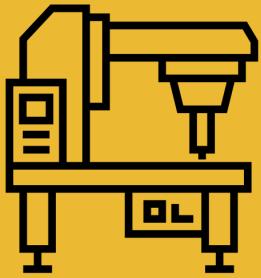
AKA: Gen X Farmers

- 38-55 Years Old
- Wholesale Vegetable Producer under 15 Varieties
- Heavy Use of tractor and large field areas
- Looking to spend less time on tractor and reduce costs



# Solutions

Distributed Tools for Decentralized Farmers



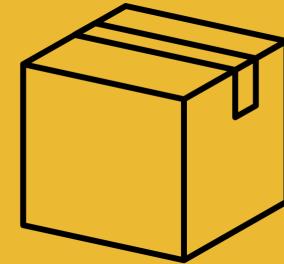
## Digital Manufacturing

Low cost solution with a focus on digital manufacturing.



## Diverse Farmscapes

A solution that scales across many plant types.

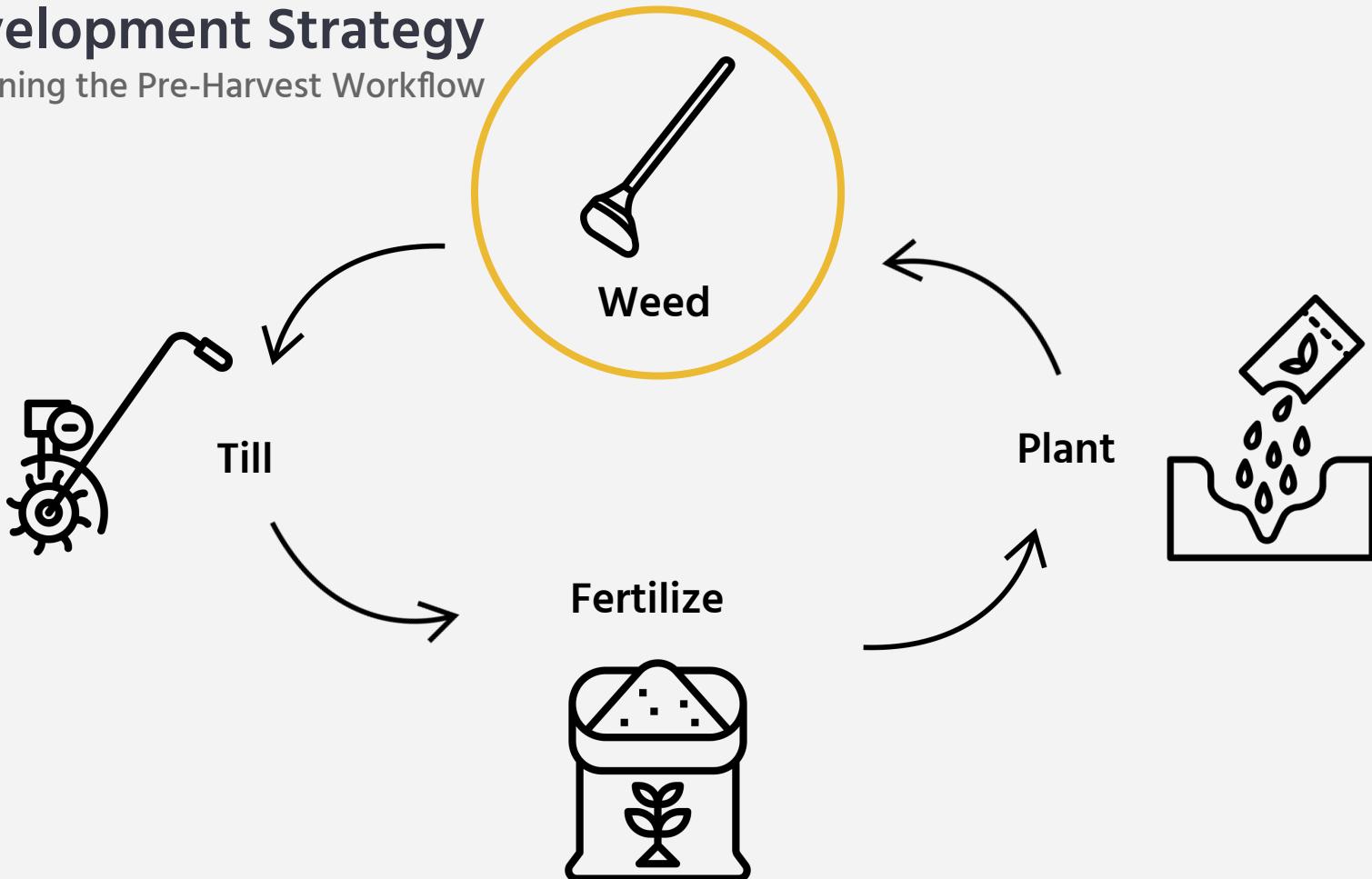


## Flat Pack Shipments

Direct sale to customers shipped partially assembled with a total weight of < 200lb.

# Development Strategy

Examining the Pre-Harvest Workflow





# Technology Roadmap

What is Likely Achievable



Weeding



Planting



Fertilizing



Tilling



Harvesting



Bunching

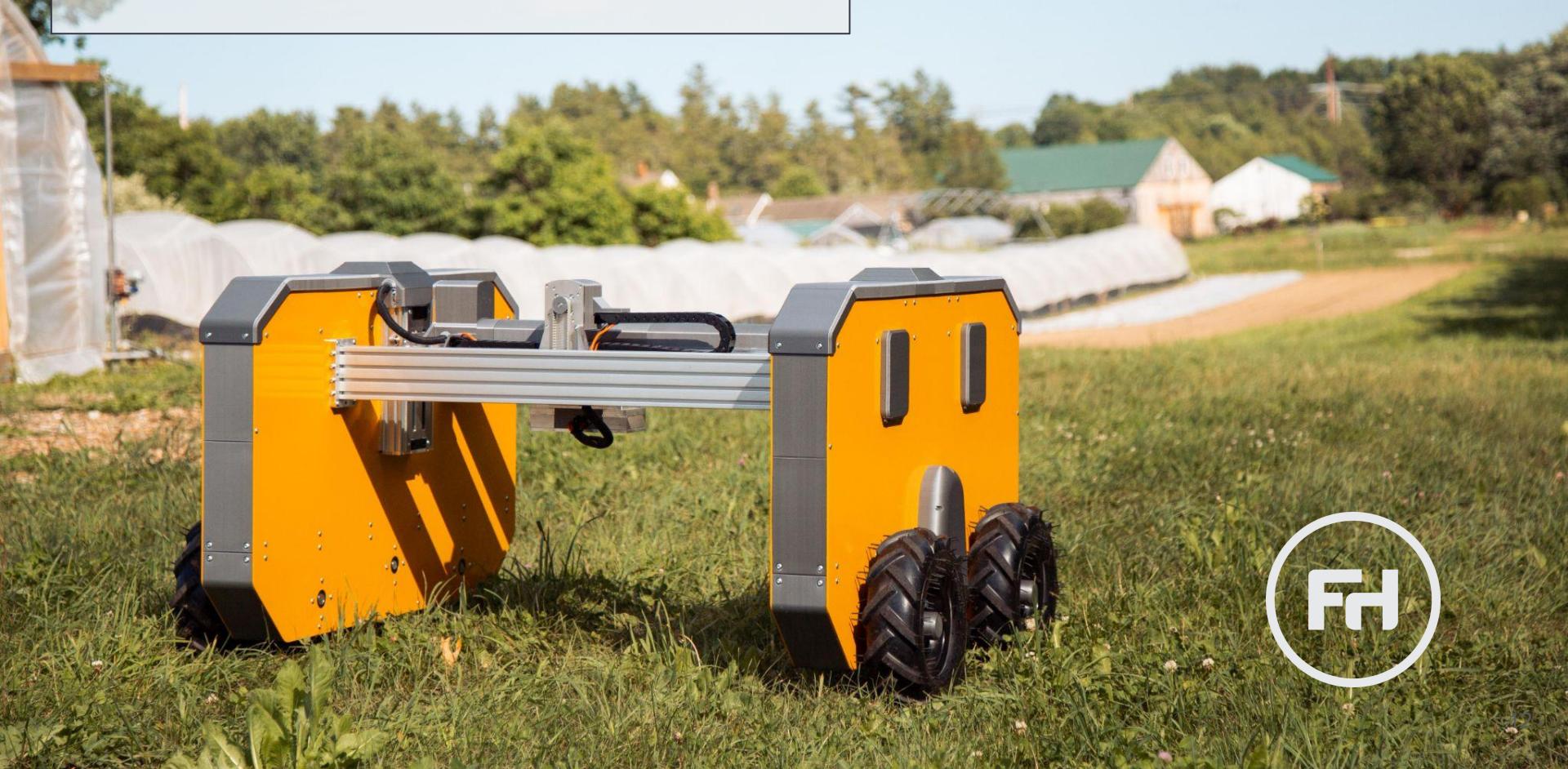


Packing

3-5 years

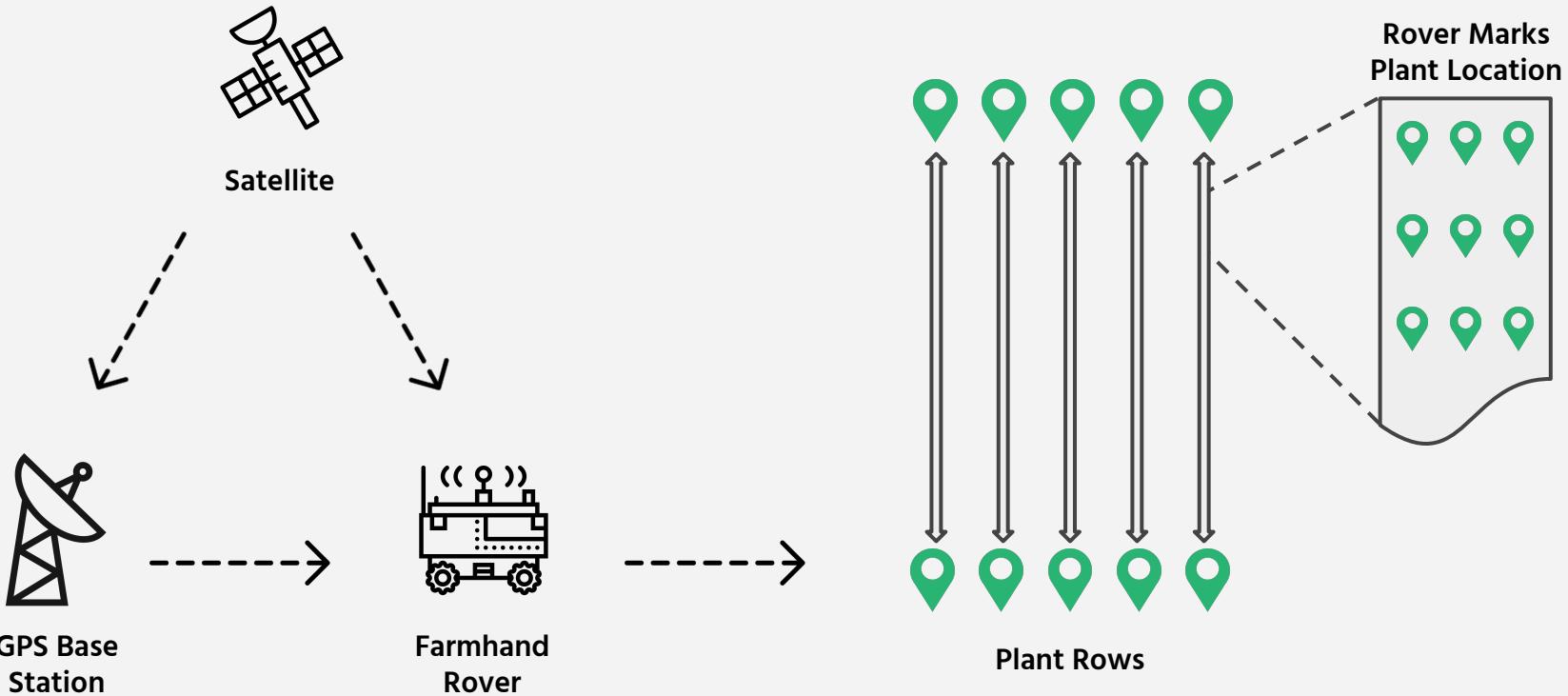
5-7 Years

# Introducing the Farmhand Rover

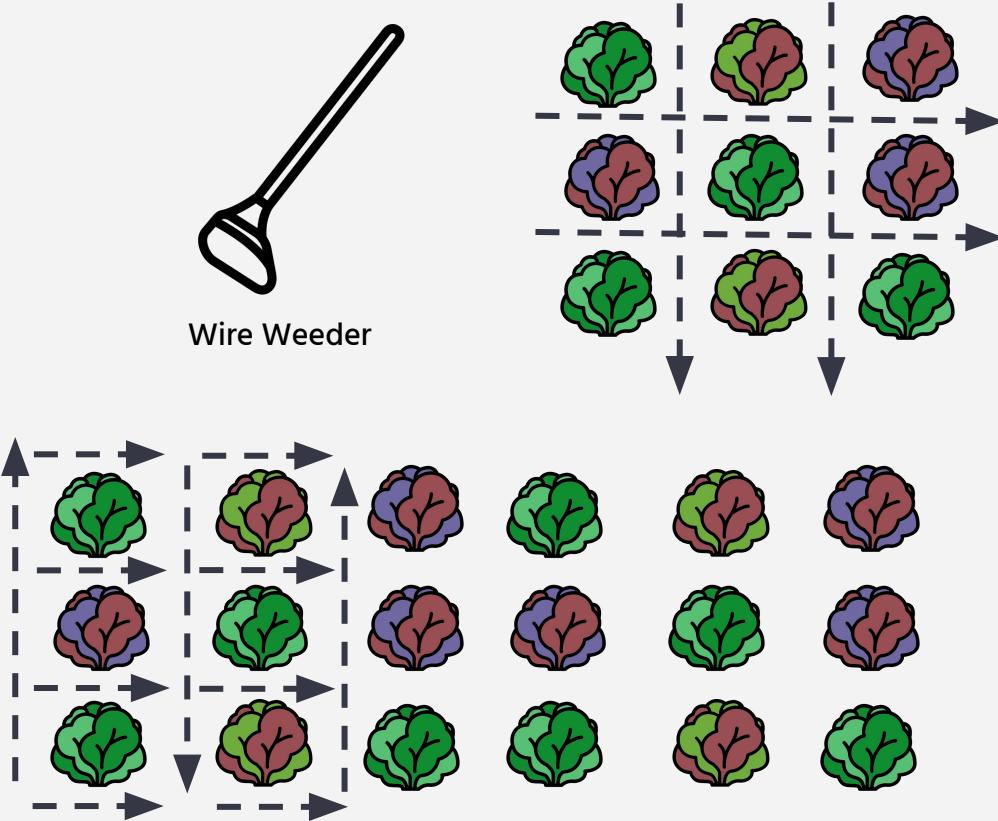
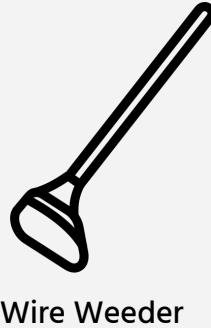
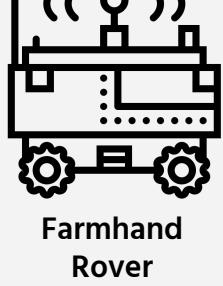


# GPS Positioning Framework

Centimeter Level Accuracy



# Our Approach to Weeding



# New Wave of GPS Positioning

Last Decade



Last 5 Years



Last 18 Months



**GPS In a Car**

**3 Feet Accuracy**

**\$300**



**Survey Grade GPS**

**12 Inch Accuracy**

**\$3000**

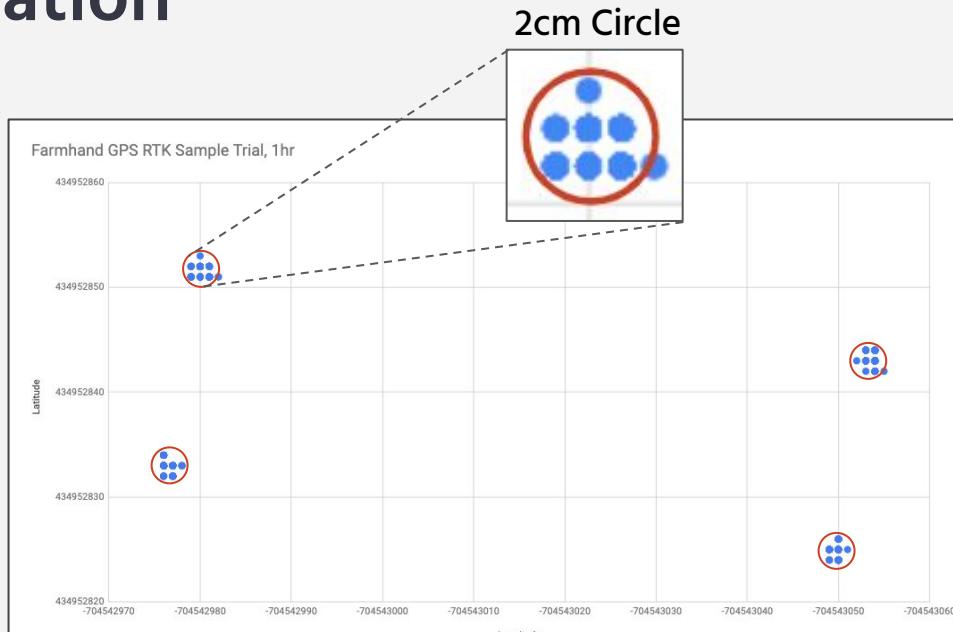
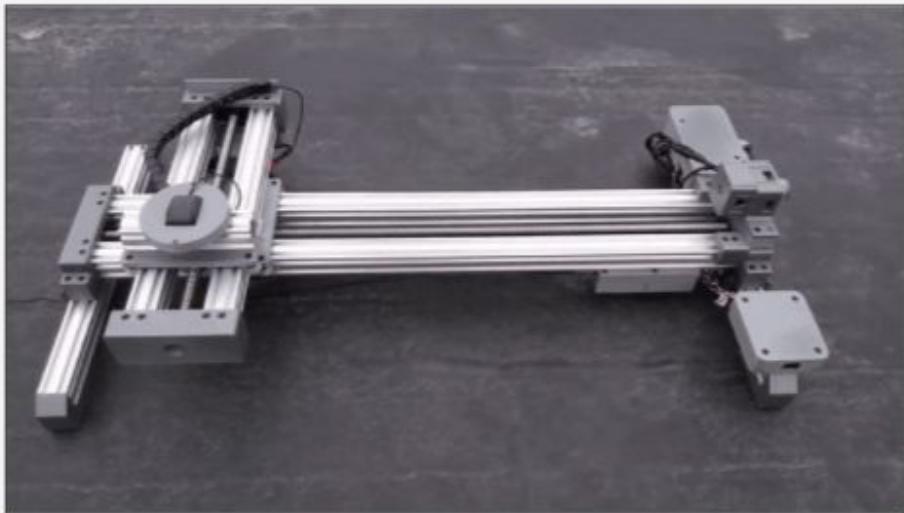


**Differential GPS**

**< 1 Inch Accuracy**

**\$200**

# Farmhand GPS Implementation



Above: Automated Testing Unit on Office Rooftop.  
97% Accuracy within +/- 1cm over 1K Cycles in Urban Environment



# Project Review: Summer 2019

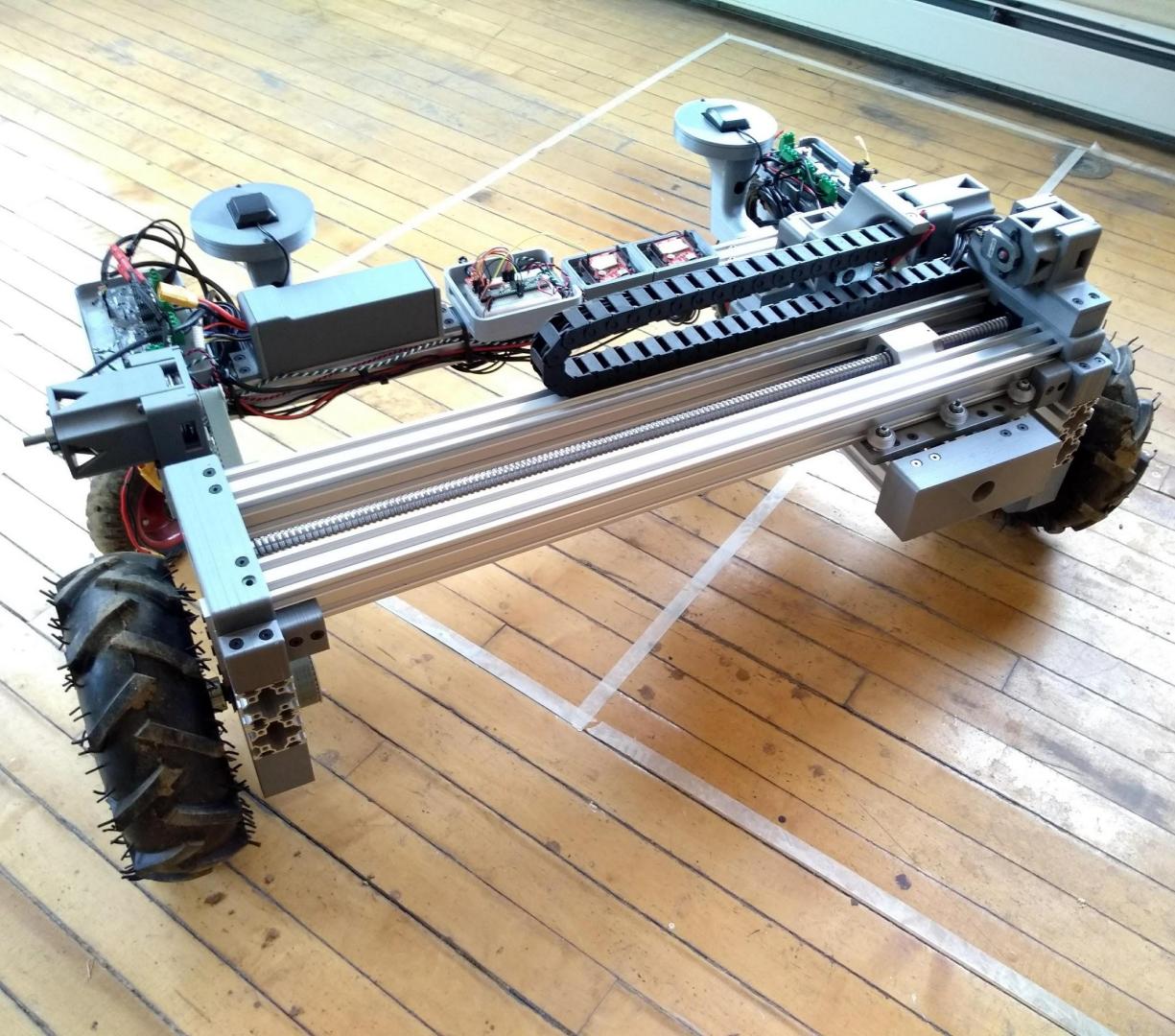




# Modular Rover

## Proof of Concept

- Designed to be accessible to small scale vegetable growers typically growing in 30" wide beds
- Modular with 2 independent drive trains with 2 x 1Kw motors
- 1605 lead screw driven 2 axis gantry for holding tools
- Dual GPS RTK for centimeter accuracy position and heading



# Community Partners



**BROADTURN**  
FARM

EST 1862

RIVERSIDE  
FARM

# Community Co-Designers



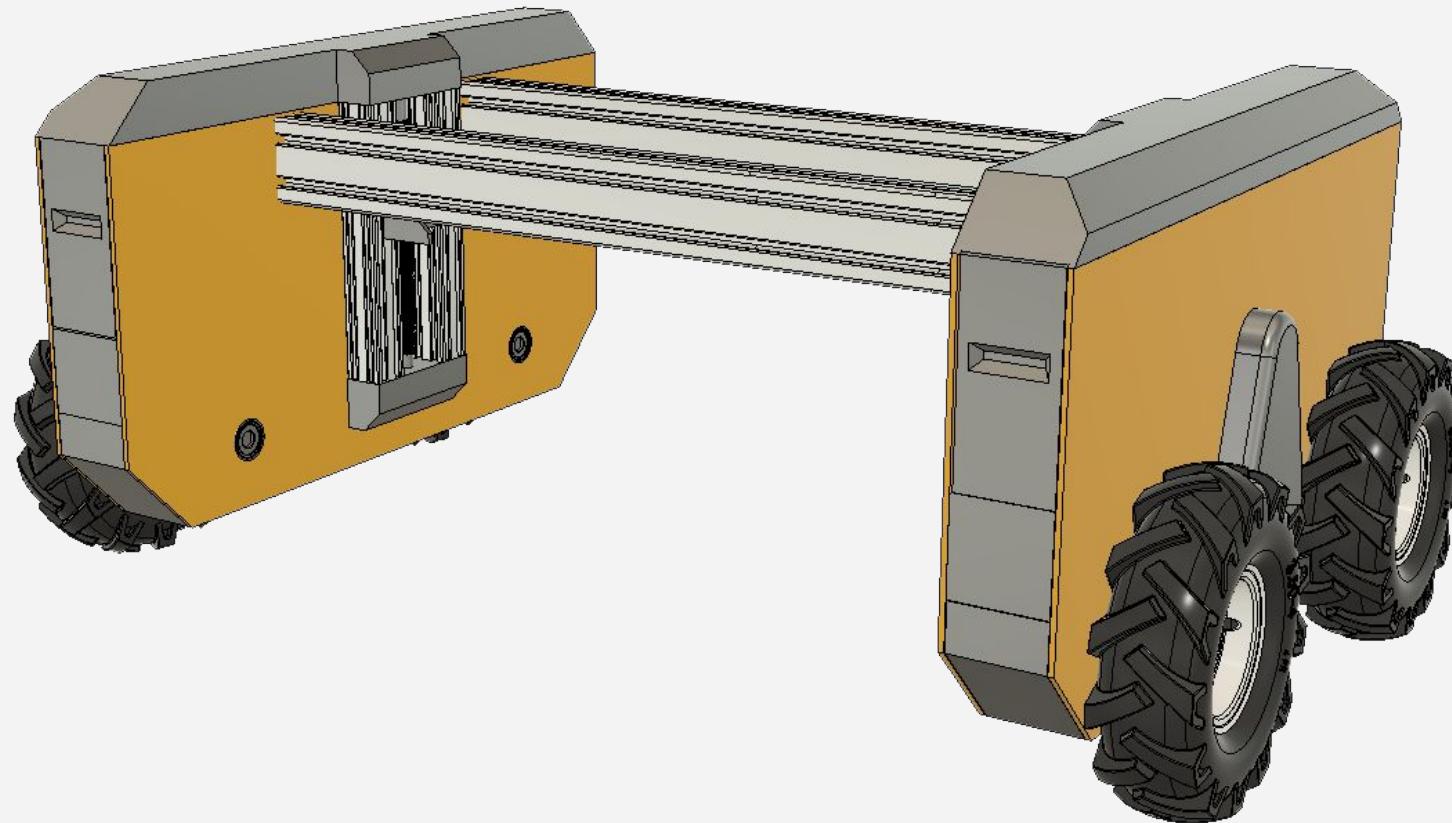


# Product Review: Summer 2020



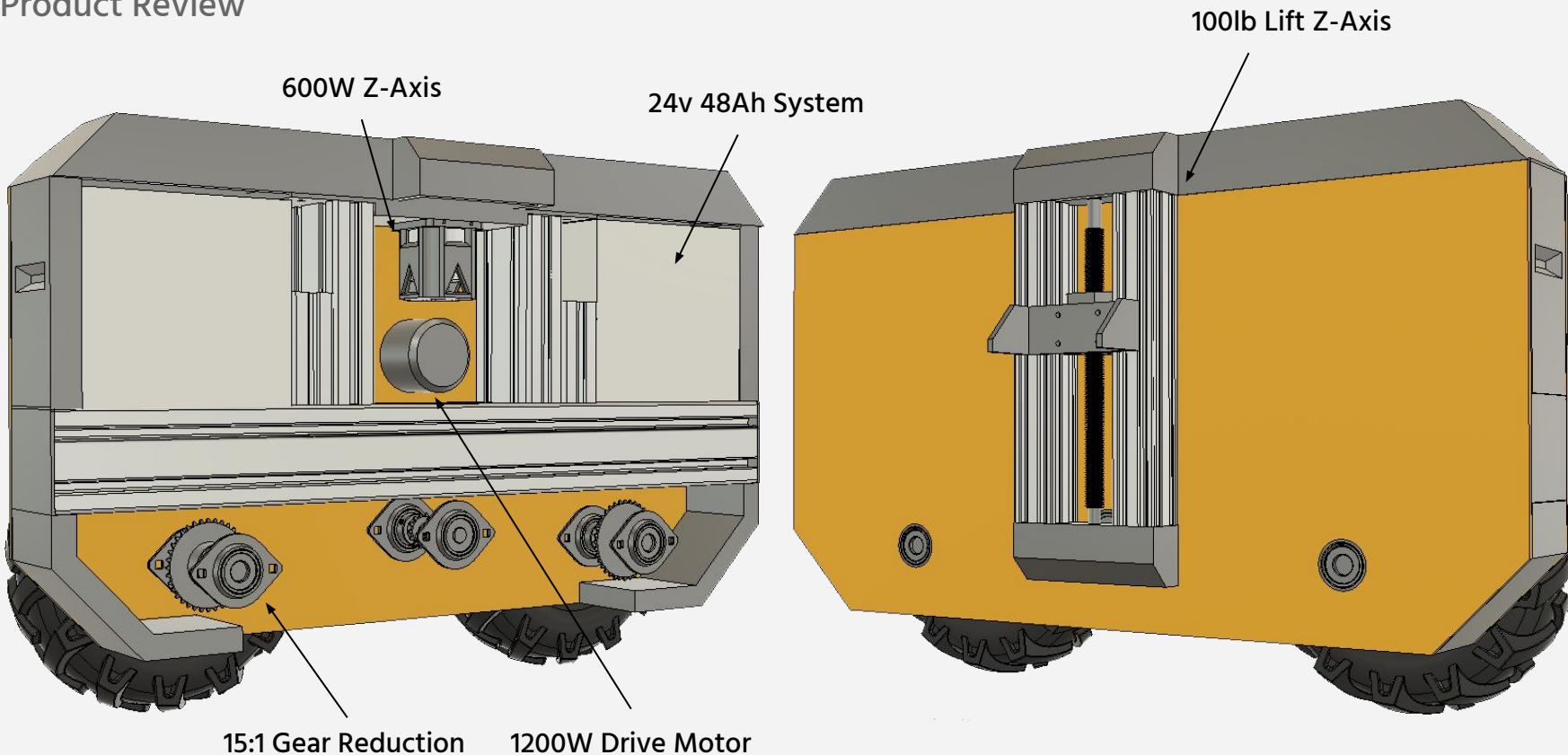
# Summer 2020 : Farmhand 2.0

Product Review



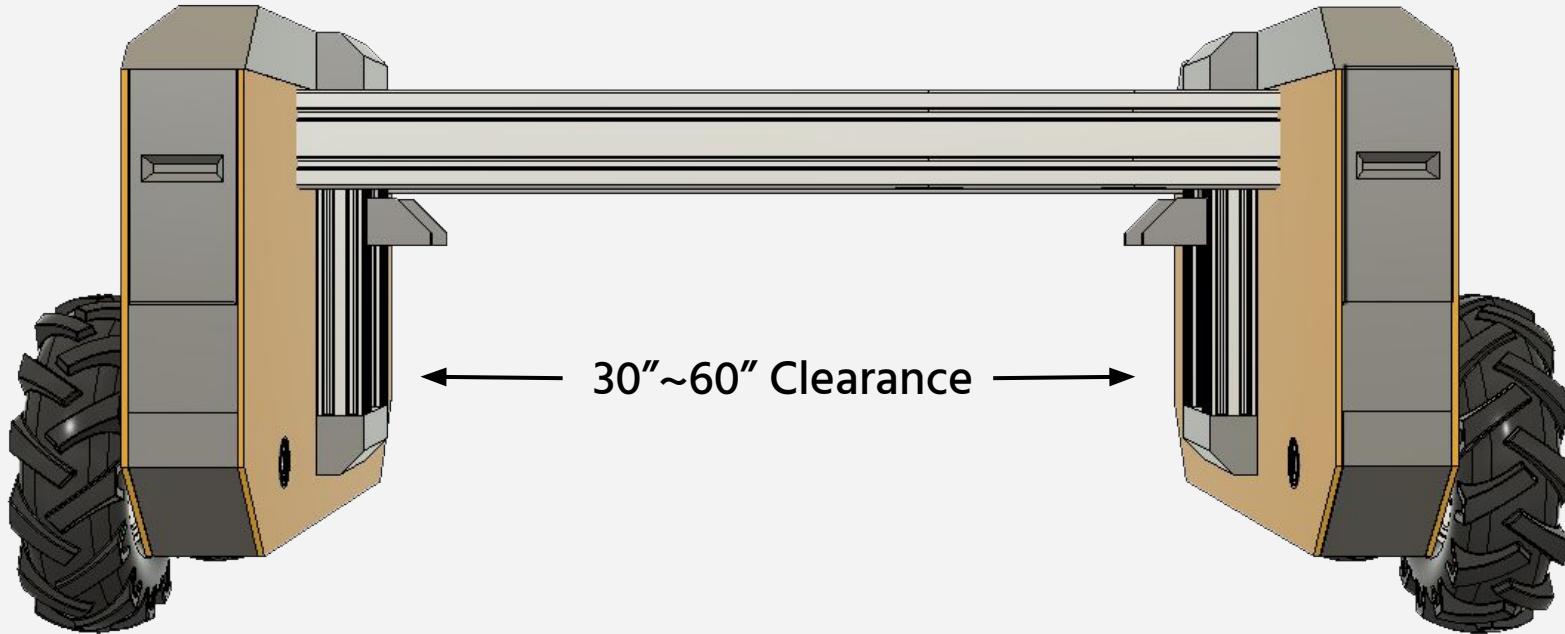
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## Product Review



# Summer 2020 : Farmhand 2.0

## Product Review



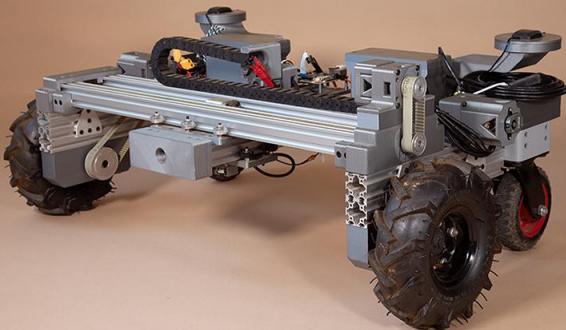


# Summer 2020 : Farmhand Rover

Product Review

## Phase 1 Prototype

- 30" x 30" Footprint
- 5" Height Clearance
- 30 lbs



## Phase 2 Prototype

- 54" x "36 Footprint
- 14" Height Clearance
- 100 Lbs





# Product Review: Summer 2021



# Summer 2021 : Farmhand Rover V3

Product Review



# Weeding in Action

Product Review



# Solar Charging and Base Station

Product Review



# CNC Machined Parts

**50**

Machined Components

**40**

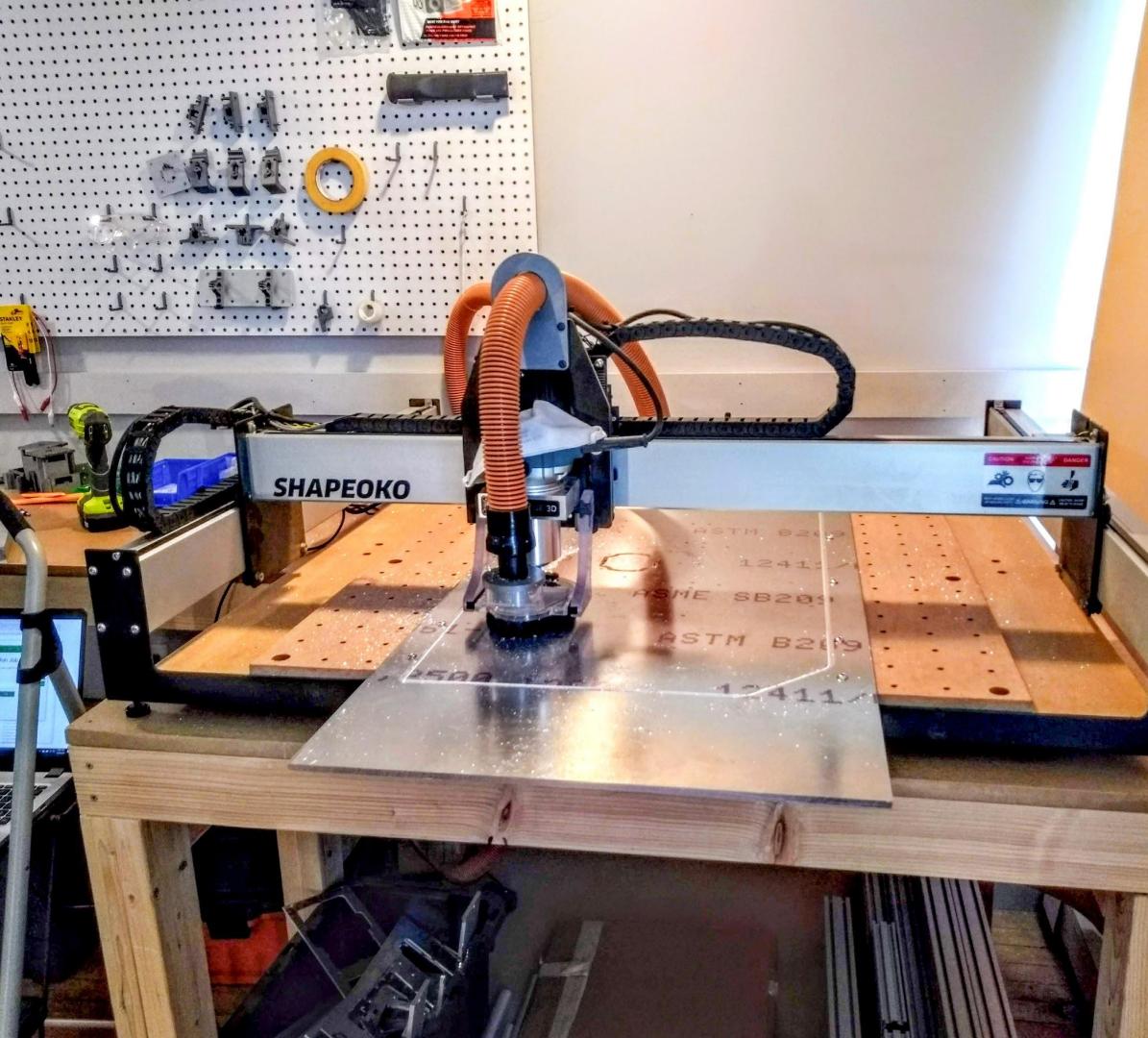
Hours of Machine Time

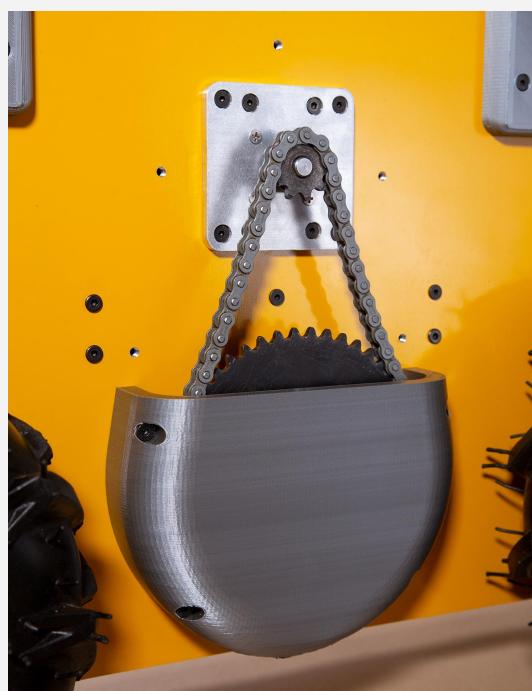
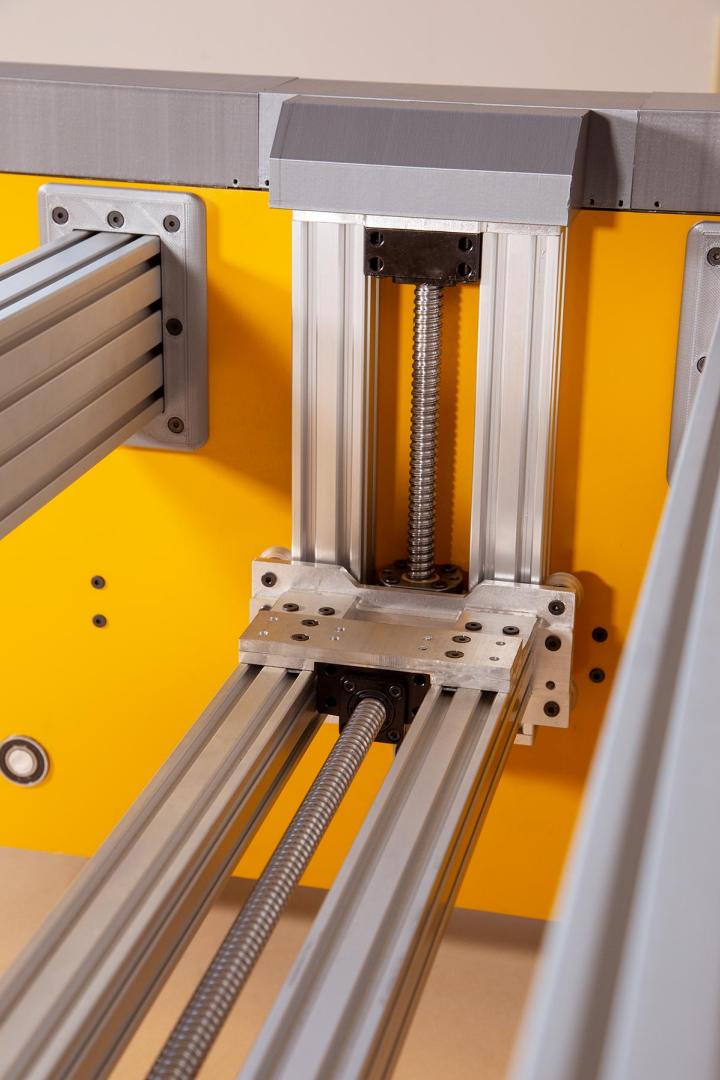
**500%**

Savings Machining In-House

**\$1,800**

Cost of CNC Machine

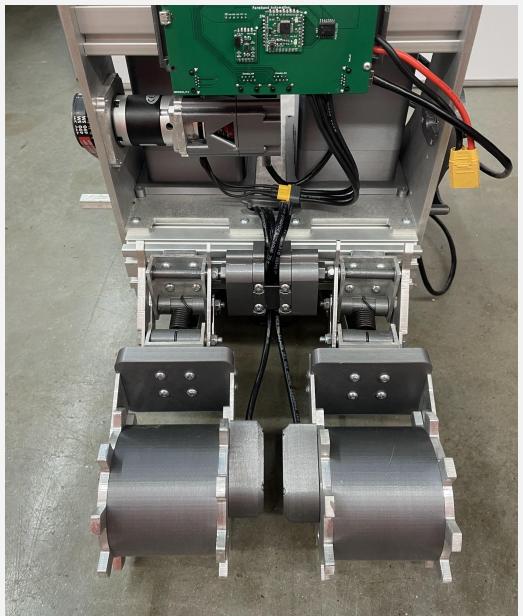
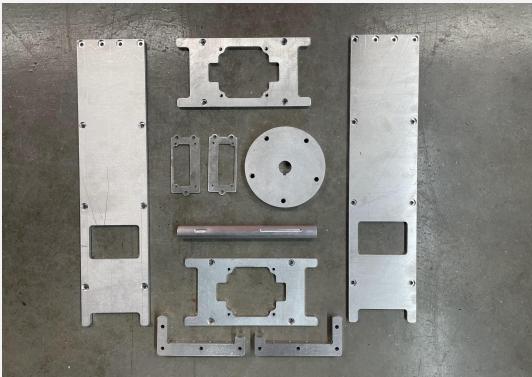
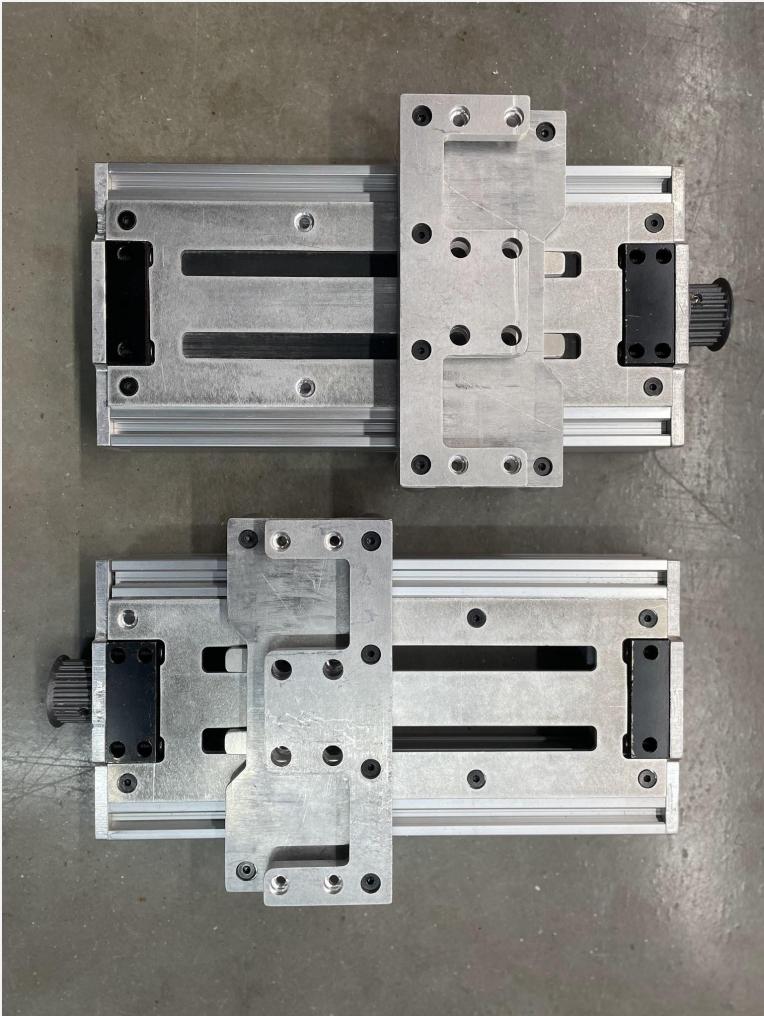




3D Printed Parts

CNC Aluminum

Chain Drive



# 3D Printed Components

**65**

Hours of Machine Time

**6.7**

Kg of Plastic Components

**\$174.13**

Total cost in plastic



# Total Costs

**\$6407.24**

Total Unit Cost in Single Quantities

**\$5,507.24**

Final BOM Cost

**2 Days**

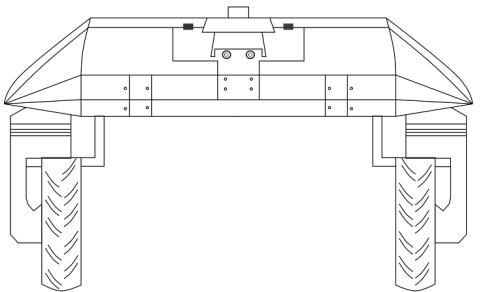
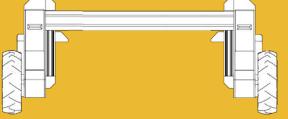
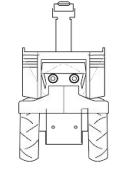
Estimated Assembly Labor

**\$500**

Estimated Freight



# Affordability of Community Robotics

			
<b>"Dino"</b>	<b>"Tharavold"</b>	<b>"Farmhand Rover"</b>	<b>"OZ"</b>
<b>Naio Technologies</b>	<b>Saga Robotics</b>	<b>Farmhand Automation</b>	<b>Naio Technologies</b>
70" Wide	78" Wide	45" Wide	15" Wide
50" High	32" High	20" High	23" High
<b>1,764 lbs</b>	<b>396 lbs</b>	<b>120 lbs</b>	<b>242 lbs</b>
<b>\$120,000</b>	<b>\$75,000</b>	<b>\$25,000</b>	<b>\$30,000</b>



# Team And Workspaces







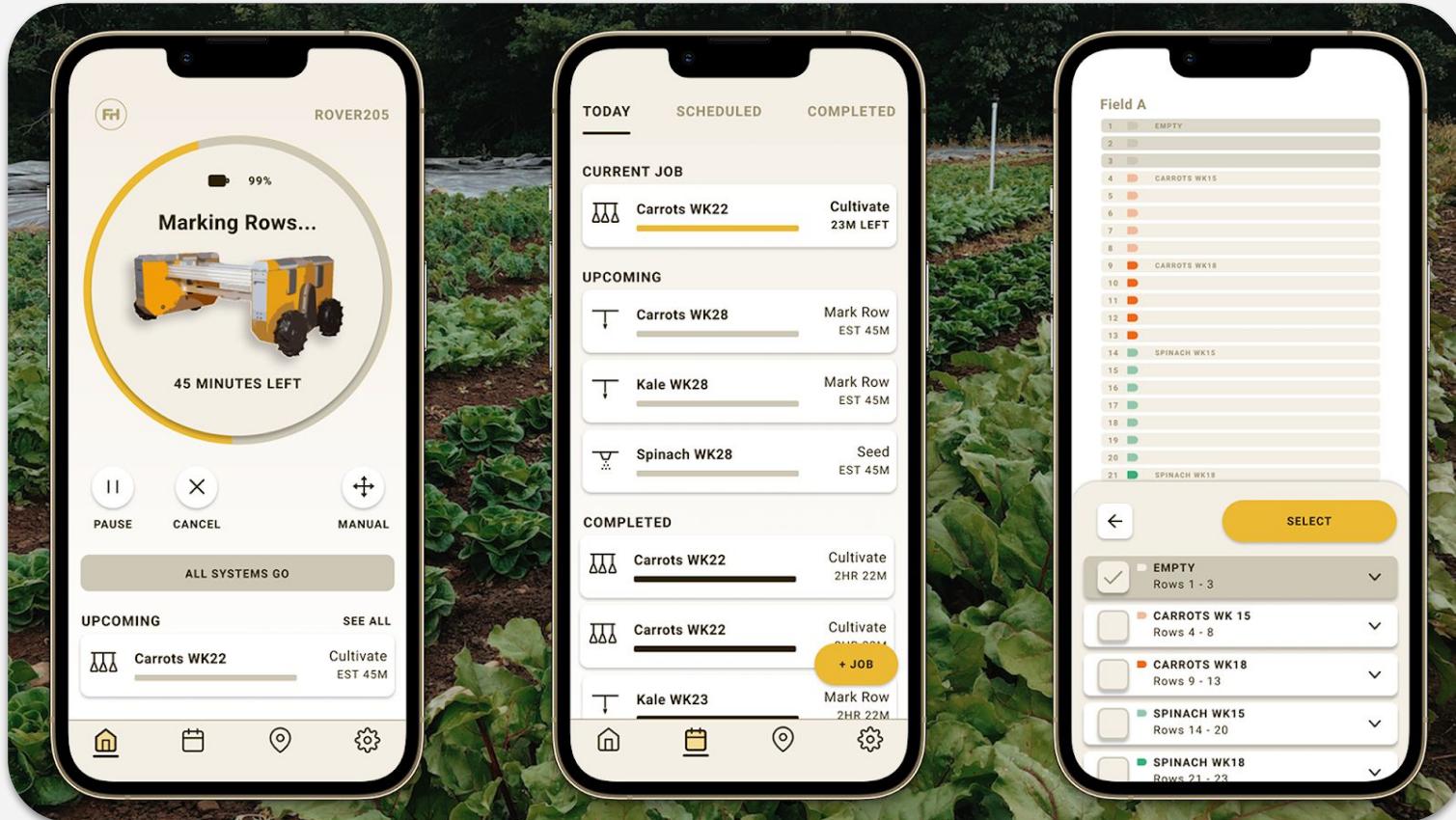


# Mobile App

User Interaction Design by Alex Jones



# Farmhand Mobile App

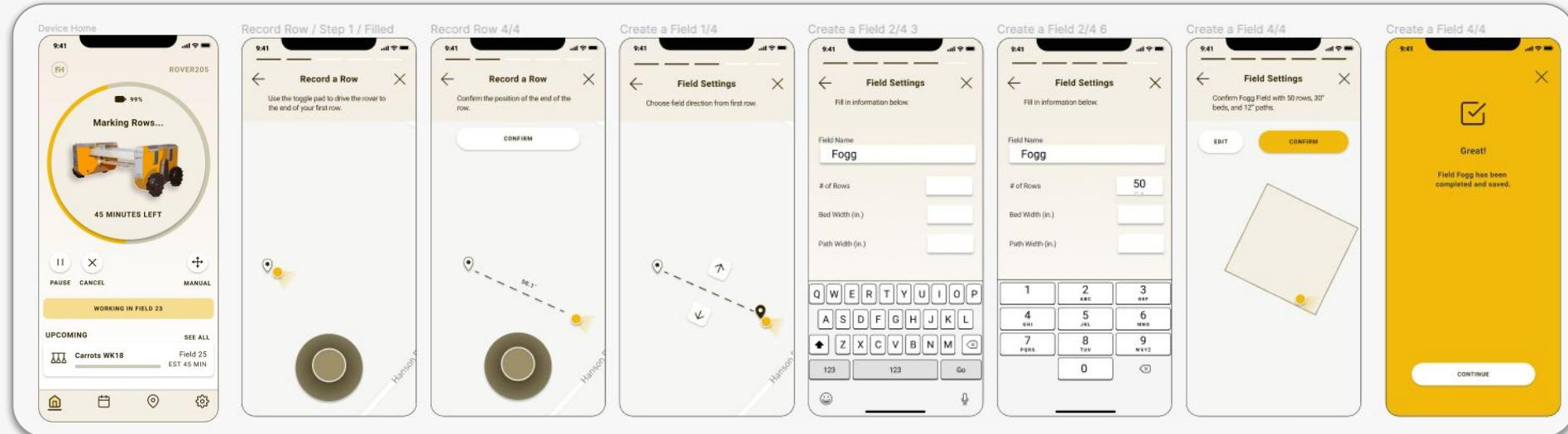


# Planting Flow for Automated Seeder

The following table summarizes the data points visible across the nine screens:

Screen	Job Status	Job Details	Action Buttons
Job - Main	TODAY, SCHEDULED, COMPLETED	Lettuce WK23 (Cultivate, 23 MIN LEFT), Carrots WK25 (Cultivate, EST 45 MIN), Radish WK35 (Seed, EST 45 MIN)	CULTIVATE, MARK ROW, SEED
Job / Add Job / Action	Add A Job	Tap a job you would like to add.	CULTIVATE, MARK ROW, SEED
Jobs Screen - Select Plant	Select A Plant	Select which plant variety to mark rows.	ADD NEW, BEAN, BEETROOT, CHARD, GARLIC, KALE, RADISH, SQUASH, BEAN, BUCKWHEAT, FENNEL, LETTUCE, ONION, SPINACH, TURNIP, BEETROOT, BUCKWHEAT, ARUGULA, BEANS, VIVIAN
Jobs Screen - Choose Intensity	Select A Plant	Select which plant variety to mark rows.	LETTUCE, BIB, GREEN, MIXED, SPICY
Jobs Screen - Choose Intensity	Select A Variety	Select which plant variety to mark rows.	CONFIRM
Jobs Screen - Choose Field	Select Rows	Pinch zoom on the map to see rows to mark.	FIELD A, FIELD B
Jobs Screen - Choose Crop	Select Crop	Sort by Plant Name	CARROTS WK15 (Rows 4 - 8), CARROTS WK16 (Rows 9 - 12), EMPTY (Rows 1 - 3), EMPTY (Rows 27 - 28), SPINACH WK15 (Rows 14 - 20)

# Direct Rover Control and Field Setup

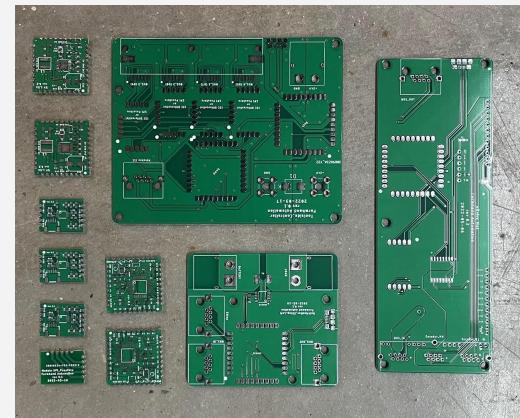
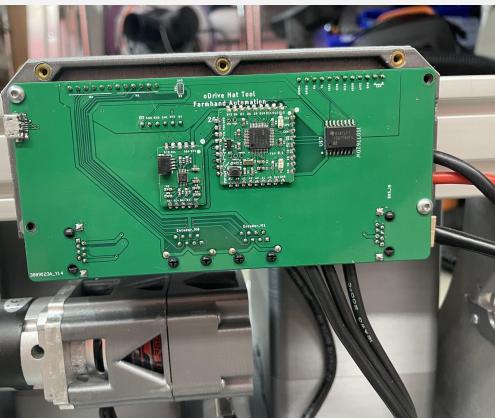
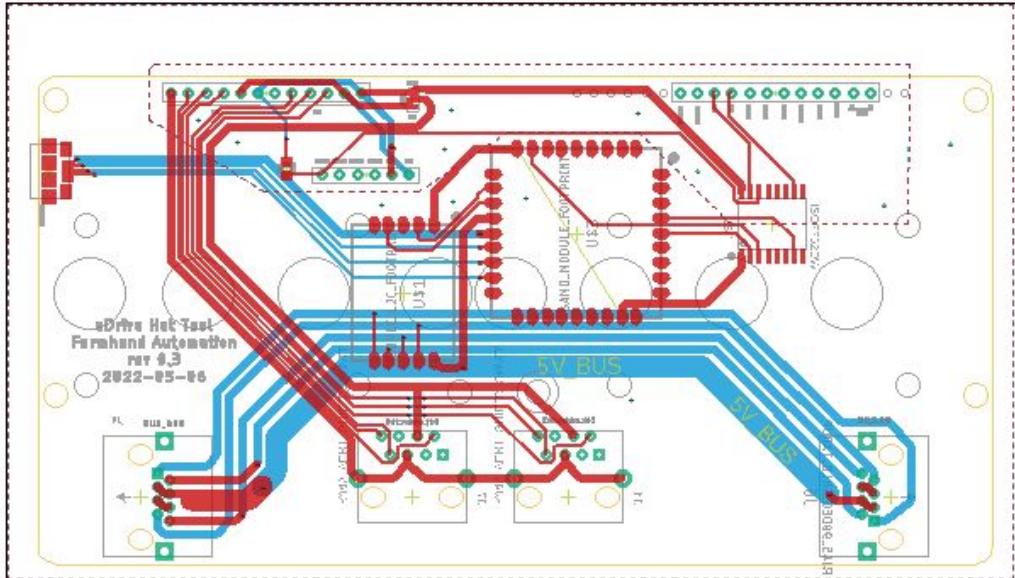
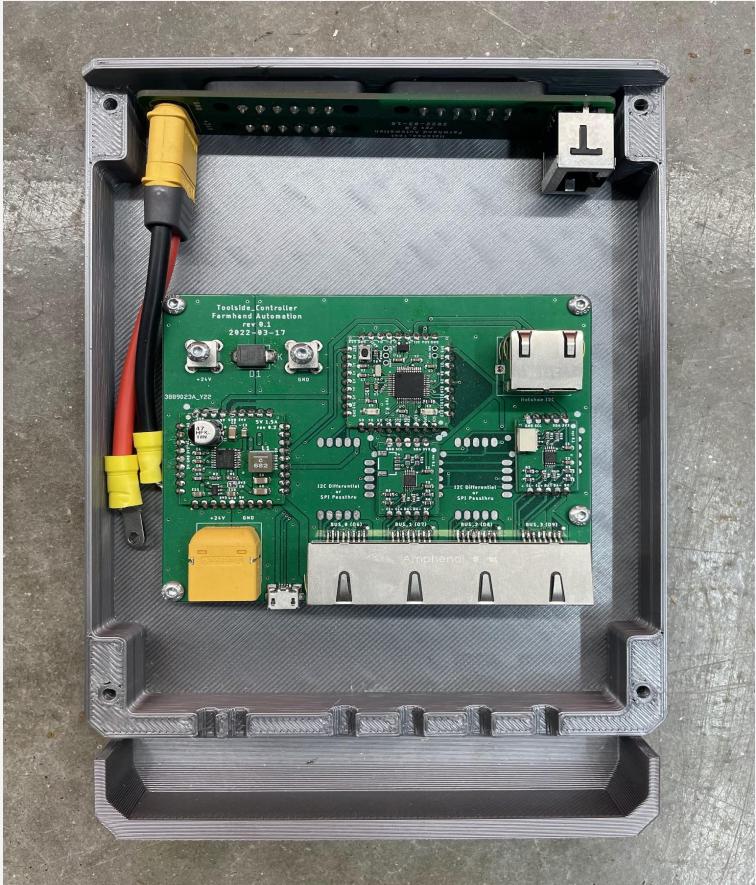




# Mentored Co-Designs With Novice Engineers



# Modular PCB Framework



# Automated Seeder Attachment



# Power Weeder Attachment

