How to make an Othermill
(using data and local manufacturing partners to do more with less)
The Othermill cutting a FabISP circuit board (sped up).
“tiny machines for giant dreams”
227 distinct parts - most of them made in the US.
Part I: Bay Area manufacturing is alive and well.
### How many do you need in year three?

<table>
<thead>
<tr>
<th>QTY</th>
<th>METHOD</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1k</td>
<td>In-house</td>
<td>Build the 1st 1000 “yourself”</td>
</tr>
<tr>
<td>1k-5k</td>
<td>Hybrid</td>
<td>In-house final assembly, nearby outsourced parts</td>
</tr>
<tr>
<td>5k-10k</td>
<td>“Local” outsourced</td>
<td>No ocean plane rides</td>
</tr>
<tr>
<td>10k+</td>
<td>Large volume mfg</td>
<td>Fully outsourced, global</td>
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Final Assembly in San Francisco

A batch of Othermills in progress.
The Heart of the Othermill: the motors

Koco Motion – motor supplier, Morgan Hill, CA, est. 2011
Start with precision, maintain precision.

Each thread corresponds to an exact amount of forward motion.
Dies for Making Lead Screws

These cost tens of thousands of dollars for one pair.
The Kinefac Machine

This machine puts threads onto rods and turns them into lead screws.
This is what puts threads on the rods and turns them into lead screws.
The Skeleton of the Othermill: the Frame
Large things cut into smaller pieces

Raw materials suppliers are also part of the ecosystem.
Sheets of HDPE from Piedmont Plastics get milled into frames.
Each sheet of HDPE is a whole Othermill frame.

The frame is a 3D object made from 2.5D parts.
The Muscle: high-precision, machined aluminum parts

Bishop-Wisecarver – precision machining, Pittsburg, CA, est. 1950
Giant milling machines making parts for tiny milling machines.
Machining aluminum with liquid cooling.
Before entering QC, every part is checked against our paper specs.
High-end, automated quality control testing is worth the investment.
Each part is probed to ensure precision to our specifications.
The Nervous System: wiring and electronics.

LeeMah – electronics manufacturing, Brisbane, CA, est. 1978
Pick-and-Place Machines (remind me of crabs!)
Circuit boards, coated with solder paste, awaiting the pick-and-place.
Inspection is done by computers.
All our factories blend machine fabrication with hand fabrication.
The Skin: packaging that gets it to your door in 227 pieces.

IBC Creative Packaging– custom packaging, Hayward, CA, est. 1959
Flexography: printing with a flexible relief plate
Inking
Why do people say domestic manufacturing is dead?
Part II: Data
Good early data habits: do more with less.

● Production Data
  ○ How many can we build?
  ○ How long does it take?
  ○ How much does it cost?
  ○ When do we need to place orders?
● Product “History”
  ○ What parts, from where, assembled by whom?
● Support Tracking
  ○ Informing engineering teams about trends
  ○ Know when to scale support
What is the weekly purchasing schedule?

<table>
<thead>
<tr>
<th>Day</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
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<tbody>
<tr>
<td>Vendor</td>
<td>McMaster</td>
<td>Digikey</td>
<td>Amazon</td>
<td>McMaster</td>
<td>Digikey</td>
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