5-1-2018

Safe Ship

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SafeShip

Designed by Kristin Renda and Dylan Courtney

The rise in online ordering means more packages are being left unattended after delivery.

SafeShip is the only discrete system that deters opportunistic theft and increases package delivery efficiency.

01

overview

Project Criteria

SafeShip is a theft deterrent doormat for packages left unattended after delivery.

Deters Theft

Beveled Edge
Steel Reinforced Net
Weighted Base
Locking Solenoid
Alarmed System

Unobtrusive Design

Beveled Edge
Interchangable Textiles
Doormat Form
Design Indicator


safe and secured

Accepts Multiple Deliveries

Locking Solenoid
Tracking Number Scanner

Intuitive to Use

Locking Solenoid
Doormat Form
Design Indicator
Tracking Number Scanner
Mobile App Notifications


safe and secured

Network

James Siminoff

CEO, Ring

- Offered valuable feedback on later design iterations and prototypes.
- Advised our design features based on his experience with Ring.
- Ring was bought by Amazon in February, 2018 for a billion dollars.

John Modestine

Creative Director, Ring

PhilaU Alumnus, 2011

- Provided valuable feedback on early ideation and form explorations.
- Validated the potential of a theft deterrent doormat (especially with the integration of Ring technology) - "The straps are genius!"
- Validated the market value.

Bob O'Leary

Chief Technology Officer, Vital Sensors Technologies

- Expert in sensor technology.
- Validated technology requirements and restraints.
- Provided feedback on engineering and manufacturing considerations.

02

research

Package Theft

26 million homeowners had a package stolen in 2017.

33% of the time, thieves look for an easy location to grab a package.

74% of packages are stolen while consumers are at work.

52% of packages stolen are worth **$25 - $150**.

Theft Victims

73% of homeowners have their packages dropped off at their front door.

67% of Americans have adjusted their schedule to be home for a delivery.

91% of homeowners recieve packages at least once a month.

Millennials tend to be more concerned about package theft than older generations.

Real Stories of Package Theft

"Our Amazon package was delivered this morning and was not there when we got home..."

"We tell them to leave packages in the garage and close the door..."

"...I do often instruct deliverers to place packages in my garage..."

"During our project, we ordered parts for a prototype and our package was stolen. The irony isn't lost on us."

"We have had items taken from our front door. It happened to our friends in town last week..."

"My friend showed me the security footage of an Amazon worker stealing a package after they took the picture for proof of delivery..."

"My grandma had a package stolen off her front porch..."

We surveyed over 200 people to get real first-hand accounts of package theft. What we learned was that most people have either experienced package theft or know someone who has. These experiences usually tend to lead people to take alternative measures to protect their packages while they are not home, incuding instructing couries to leave their packages somewhere other than the front doorstep.

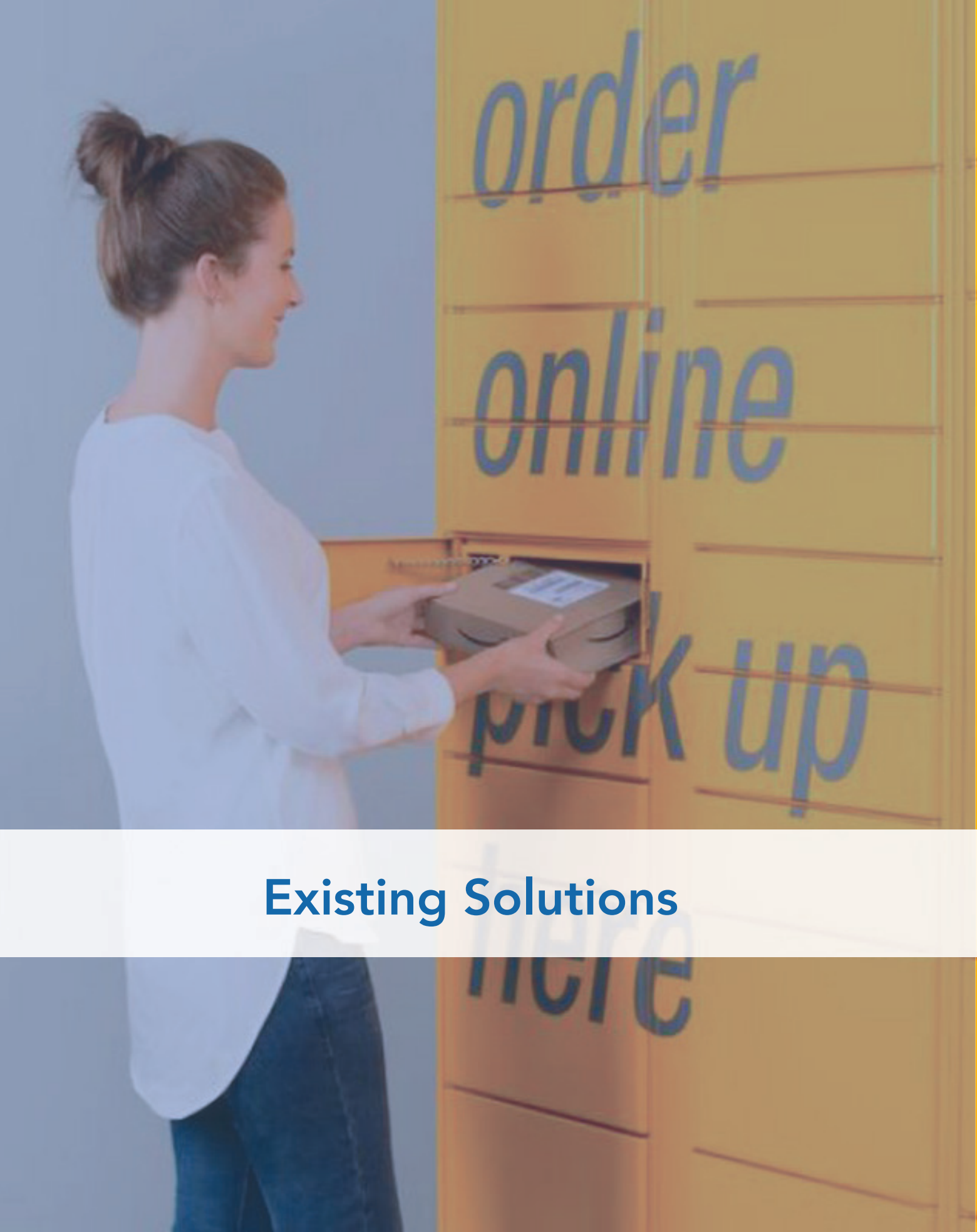
Target Demographic

Homeowners

We designed with the average homeowner in mind because the majority of package thefts reported are from people's front porches. Other living environments such as apartments usually have their own package delivery system and security measures in place. Homeowners are the most vulnerable to package theft.

Age Range: 24 - 50 years

Our target age group represents 42% of online shoppers. On average they spend about $2,000 online annually, more than any other age group. This age group is also the most concerned with package theft. 52% of packages stolen are woth between $25 and $150.



Existing Solutions

24% of homeowners sent packages to a holding facility to pick up later.

23% of homeowners left a note for mail couriers to instruct them to hide a package.

49% of homeowners stayed home to recieve a package.

72% of homeowners do not feel comfortable giving courier services access to their home.

80% of homeowners would rather invest in tech to see who comes to their front door than spend money replacing packages.

Cameras and Alarms

Security cameras give you a great front-row-seat to watching your property get stolen. Cameras and alarm systems do not effectively deter theft.

Security Cameras

Package Guard

Weight sensitive saucer. Packages are placed on top, and when removed an alarm sounds. Kickstarter project.

Ring Doorbell

Doorbell with two-way speakers and video camera. Gives the appearance that someone is always home.

Package Lockers

Package lockers take the convenience out of online shopping. Part of the benefit of ordering online is that the purchase is delivered directly to your front step.

Amazon Locker

UPS Access Point

Luxer One

Package Lockboxes

Lockboxes tend to be large and bulky, creating an eyesore on your front porch. You must also remember to leave it unlocked when expecting a delivery, and once a package is delivered a courier cannot open it again for a second delivery.

Parcel Accepting Vault

Mail Boss

Landport

Parcel Protector

Smart Lock System

Amazon Key is a smart lock that can unlock your door for a courier to deliver a package directly inside your home. However, if you are concerned about theft on your front door step, you are probably concerned about allowing strangers in your home unattended.

amazon key

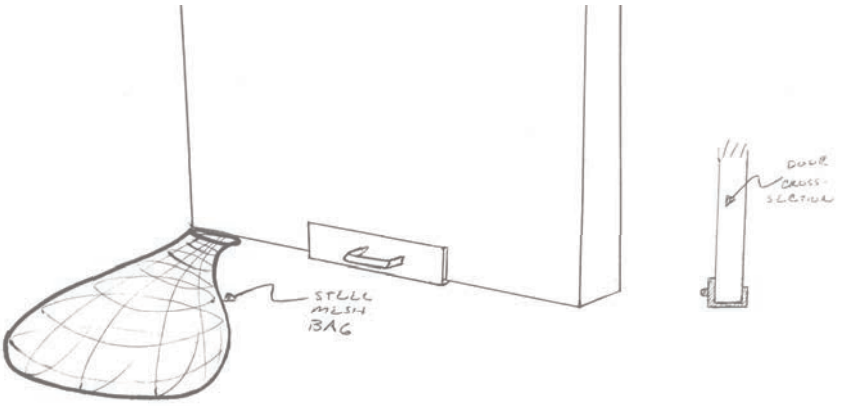
It was necessary to strike a balance between convenience and the ability to deter theft. The existing products on the market often do not balance either. Video surveillance is only able to give homeowners the view of theft in the process and package storage solutions are often large and become an eyesore. Amazon Key is innovative in an attempt to resolve the issue, but does not put a stop to package theft. The opportunity is clear that it needs to deter theft and be flexible to all stakeholders involved.

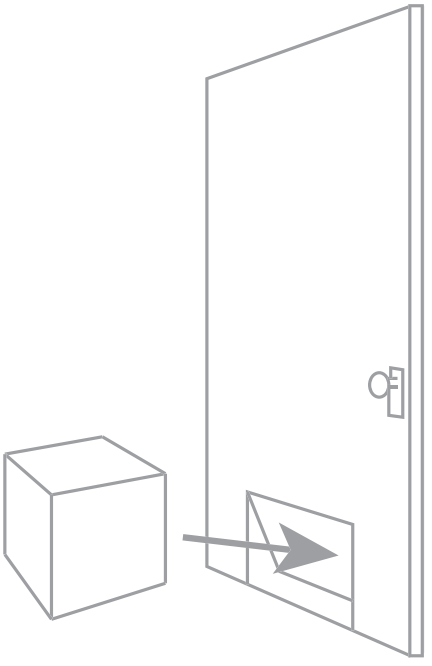
The research we conducted demonstrated the varying sizes of parcels. The ability to secure packages from seperate deliveries remains difficult. Amazon Key remains innovative because it allows multiple deliveries in a single day, but it is not innovative in that the majority of the population are not comfortable with giving up their privacy yet. The opportunity lies in the middle of developing a product that is not obtrusive, but deters theft and meets the user's needs.

03

design development

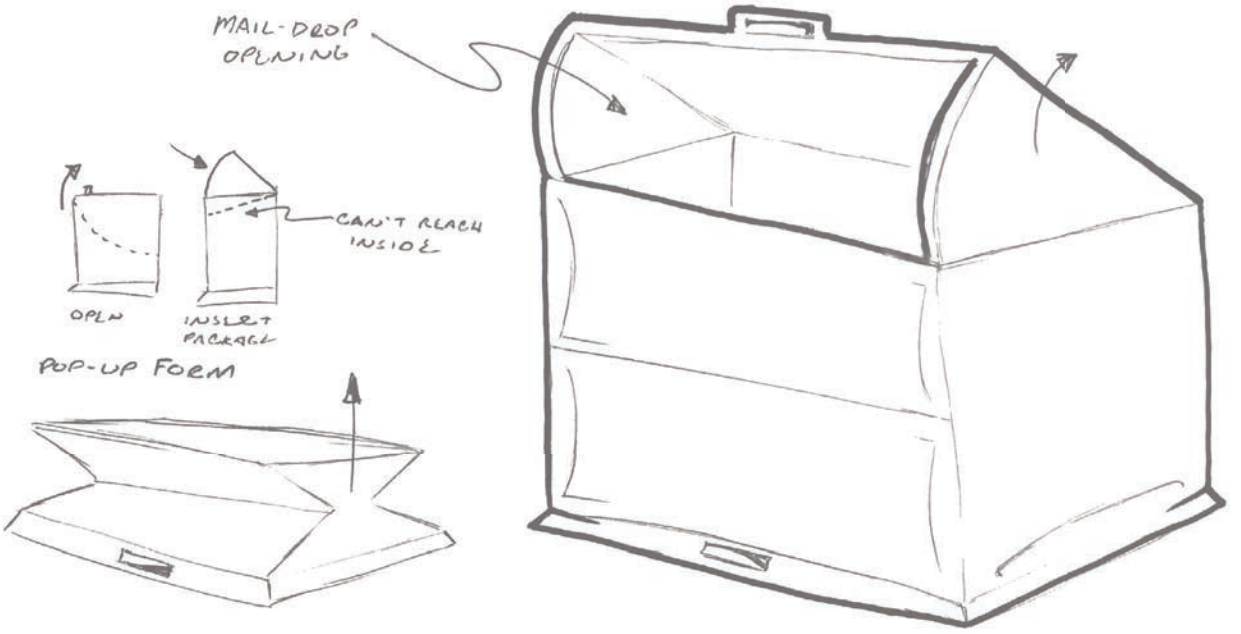
Early Concepts

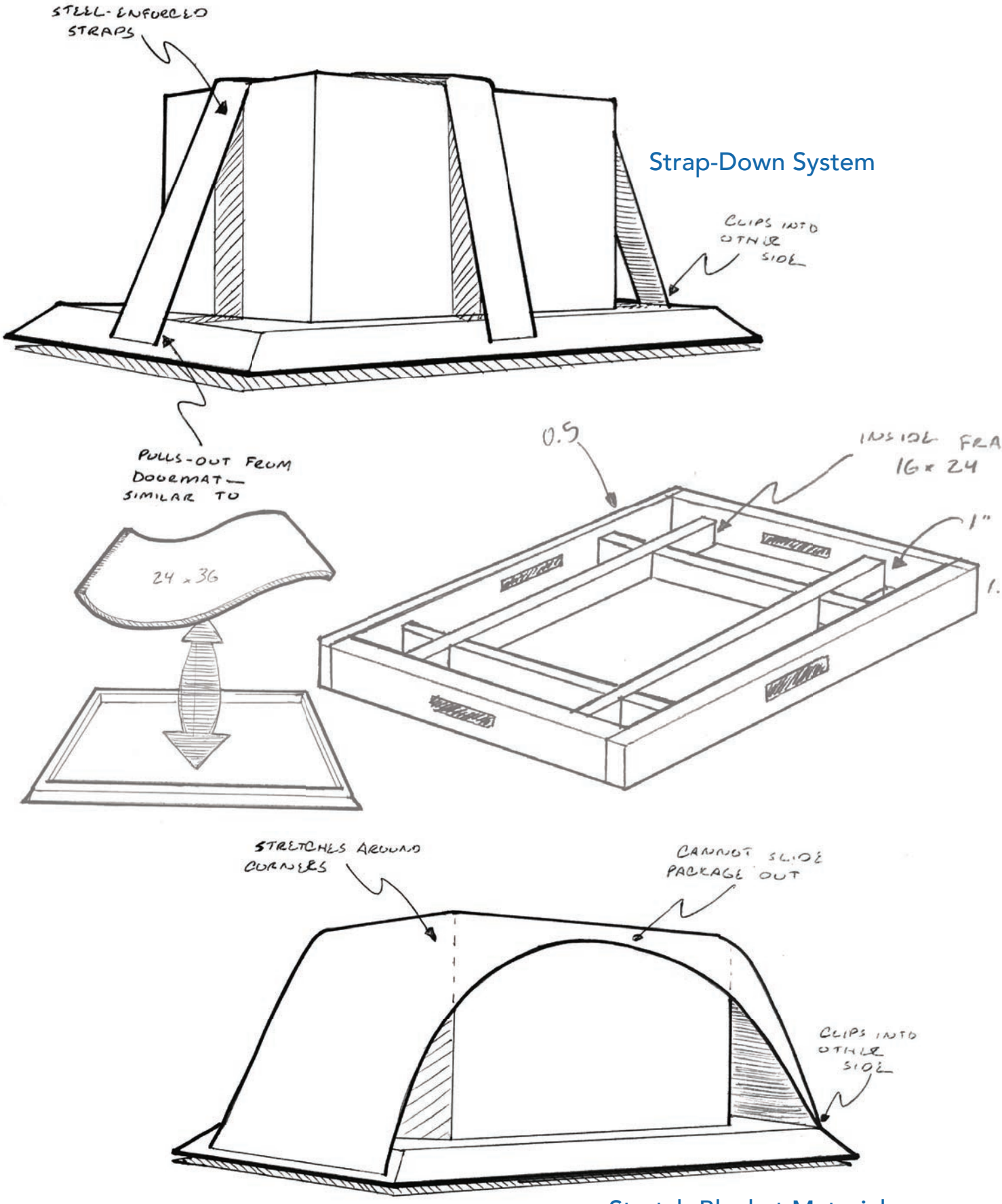




Our earliest design concepts focused on solutions that could live on a front porch. We wanted to utilize the existing method of package delivery: a courier comes to the front door to deliver a package.

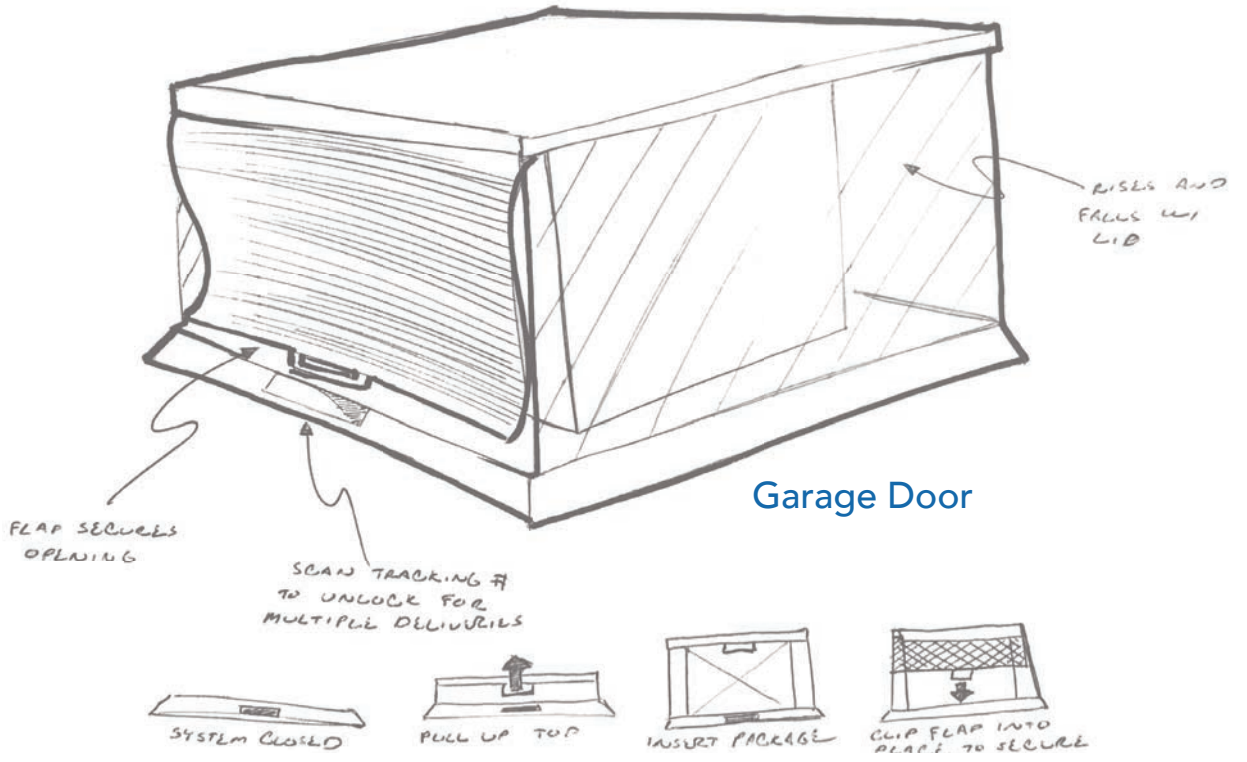
The most plausible ideas were ones that limited the amount of space that they would take up on a front porch. To maximize the amount of homes where this solution could work, we knew we could only depend on the area directly in front of the door for our design.



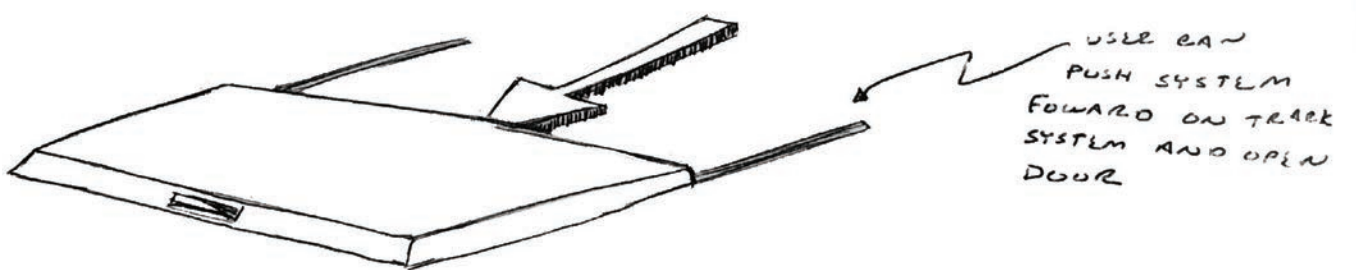


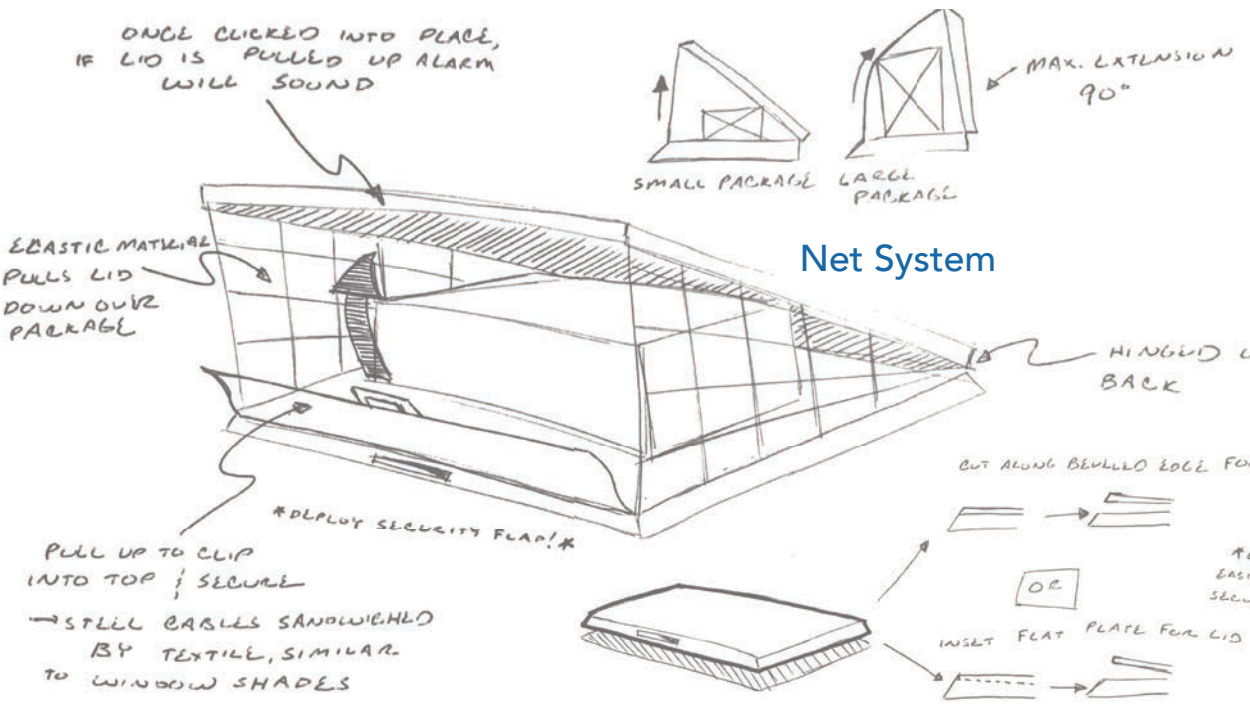
Strap-Down System

Stretch-Blanket Material

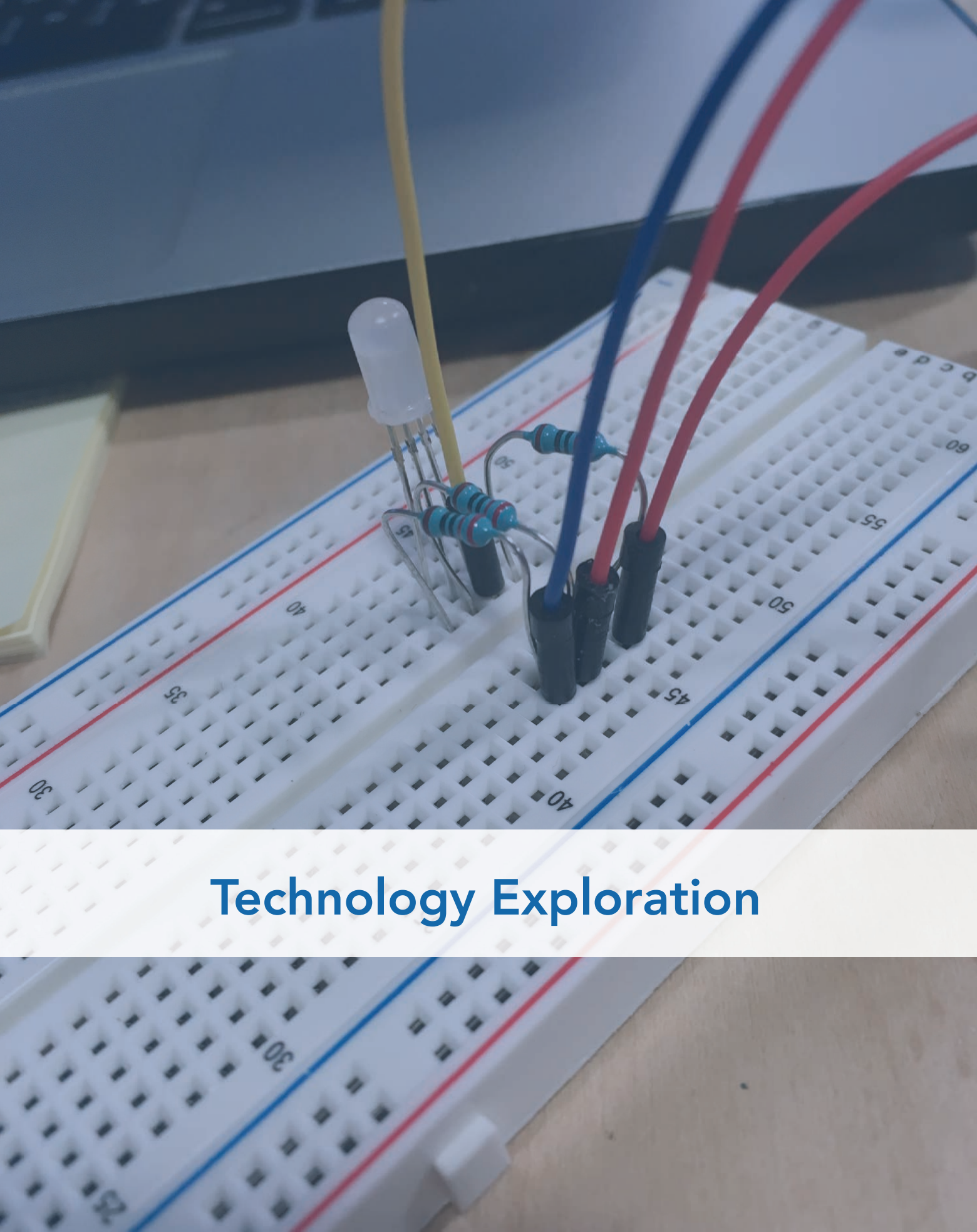


Garage Door



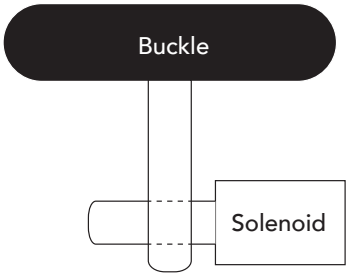


Net System

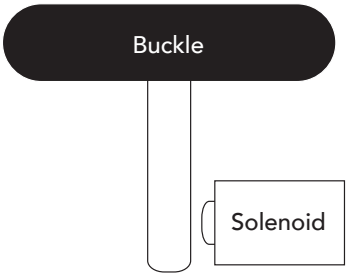


Technology Exploration

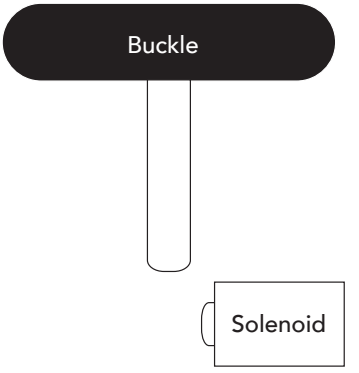
Solenoid Lock



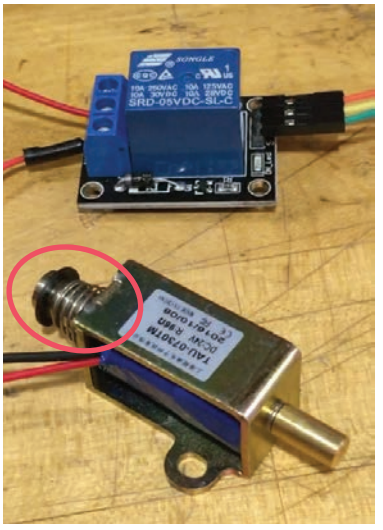
Solenoid in "Off" position.
Buckle secured.

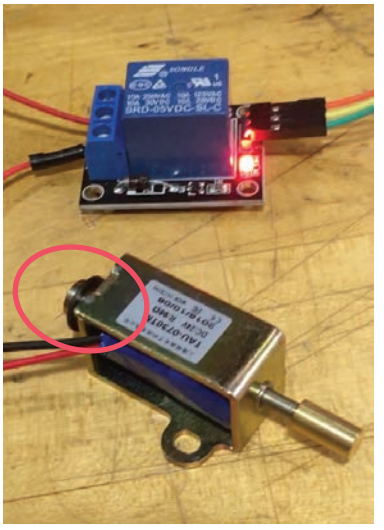


Solenoid in "On" position.



Buckle can be released.

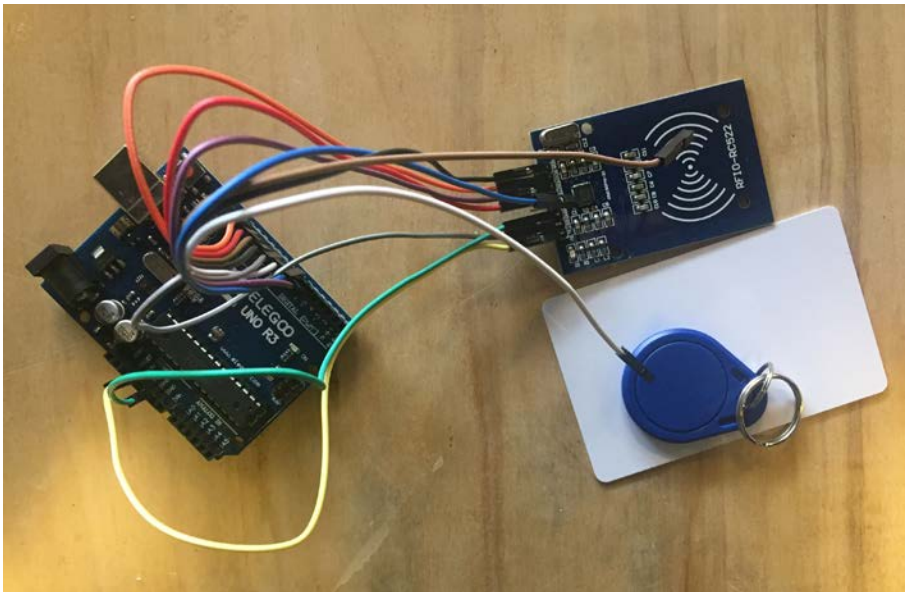


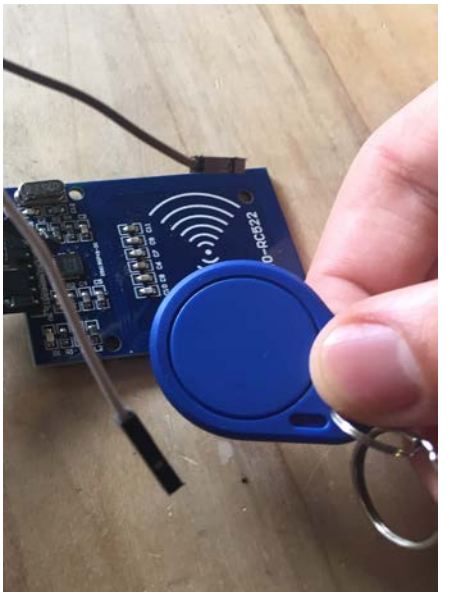


Using Arduino we programmed a solenoid to act as the locking mechanism.

While the system is locked, the solenoid is in the "Off" position to conserve energy.

RFID Card



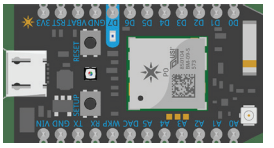


Our original design used RFID technology to unlock the doormat and net. The homeowner would use a keychain or card to unlock the net. However, we were unsure how the courier would gain access to the net without having their own key. This is when we came up with the idea to use a tracking number scanner instead.

Bob O'Leary

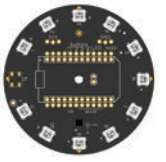
Bob was extremely helpful in helping us identify the kind of technology we would need to make our product function. He also helped to validate the idea of having a tracking number scanner to unlock the doormat.

Particle Photon



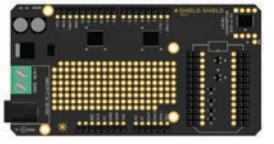
The Particle Photon is the brains of the kit, providing everything for SafeShip to be a connected product. It combines a powerful ARM Cortex M3 micro-controller with a Broadcom Wi-Fi chip in a small package. It is open source allowing maximum flexibility and integration. It has the option of being mounted to a breadboard.

Internet Button



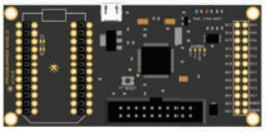
The Internet Button is the chip that allows SafeShip to communicate to existing systems or to notify the homeowner of package delivery and theft.

Shield Shield



The Shield Shield is needed to make two systems communicate a different voltage language. It performs the necessary voltage translation and provides the ability to be compatible with Arduino accessories.

Programmer Shield



The Programmer Shield gives the ability to control the electronic details and for the delivery and theft notifcations to be executed.

Particle Kit

The Particle Kit would connect to SafeShip powered by a rechargable mophie battery and an emergency mophie battery.

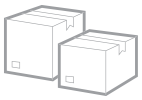
04

prototyping

Initial Prototypes

Beveled edge and weight could help prevent theives from removing packages.

System looks like doormat when not in use.

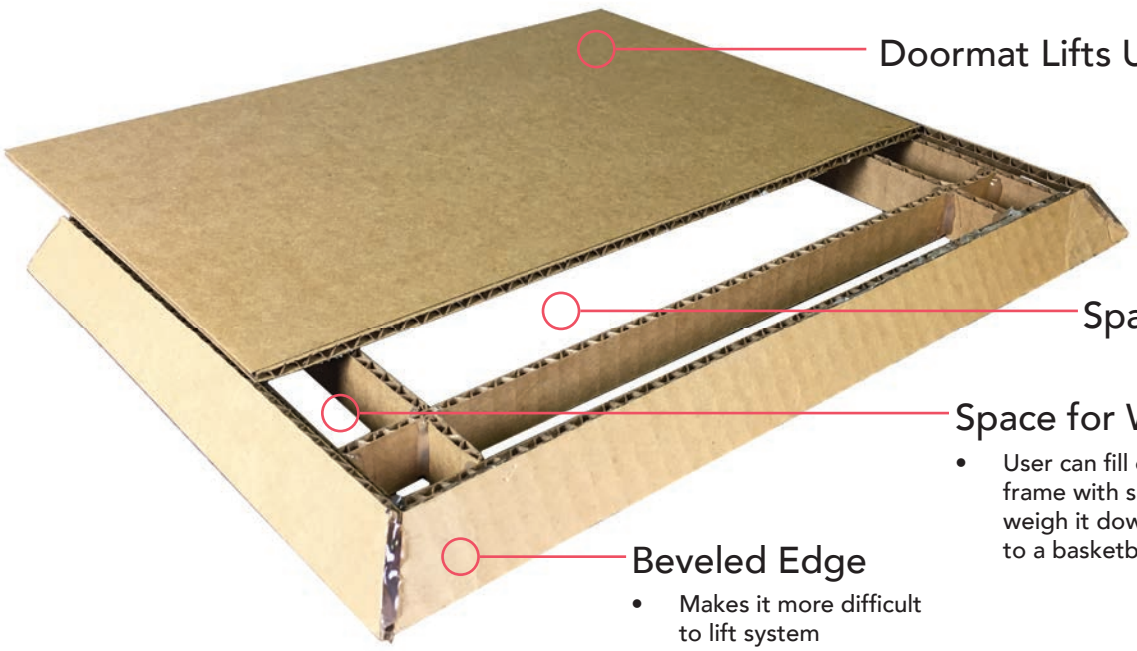


Cardboard Mock-Up

This was the first physical visualization of our project. This model helped us realize we would only need beveled edges on three sides, the fourth would be flush against a wall or door.

Further Considerations:

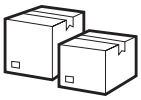
- How much space do we need for weights?
- How much space do we need for rolled straps?
- How much space will the internal technology need?



- User can fill outside frame with sand to weigh it down, similar to a basketball hoop.

- Makes it more difficult to lift system
- Only need beveled edge on three sides

Multiple packages can be pushed out from underneath strap system.



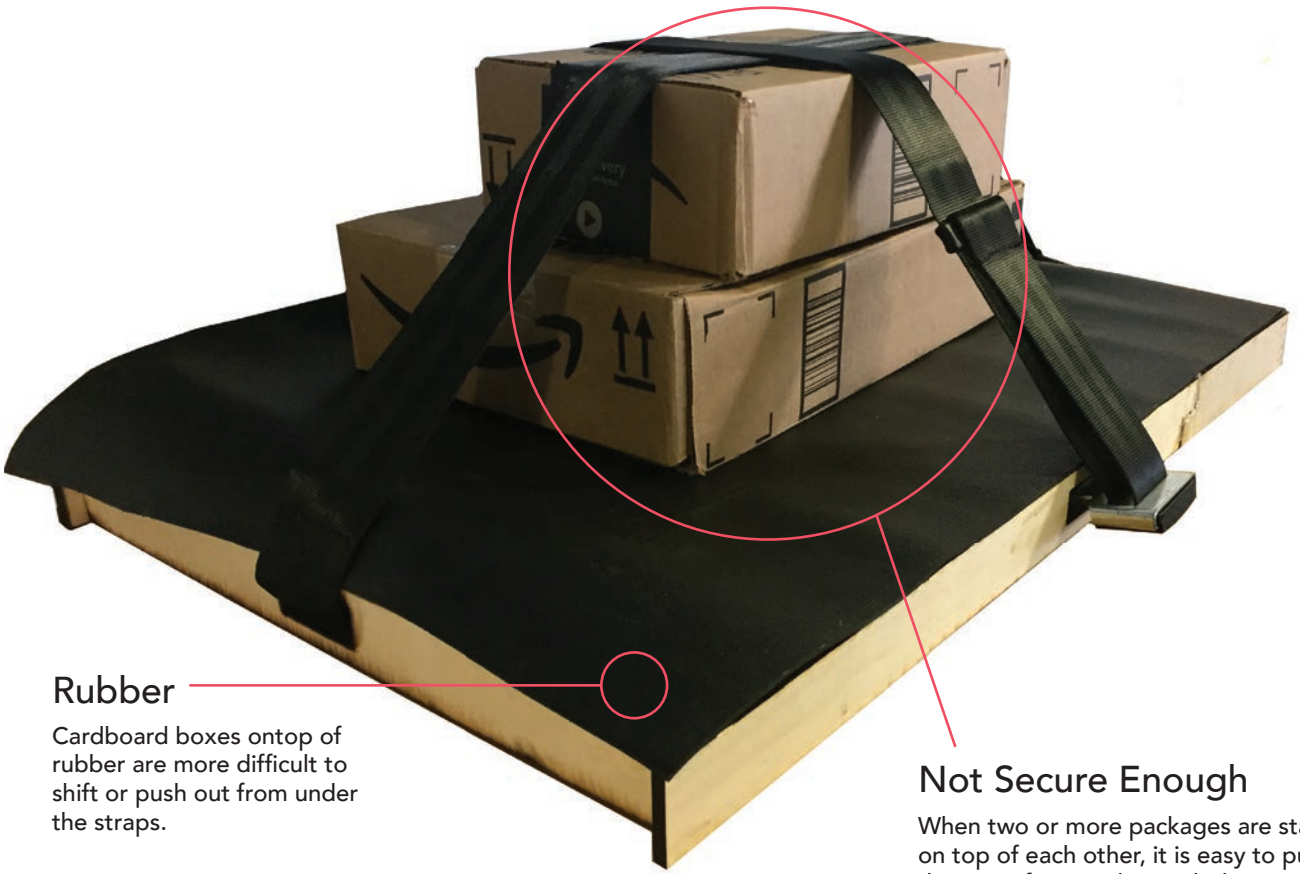
Strap system can hold multiple packages.

Seatbelts for Straps

When the straps were used to secure a single package they worked well. When two or more packages were secured it was easy to slip the packages out.

Further Considerations:

- Intuitive design for where the belts clip into the sides.
- How long can the straps be to hold the most packages?



Rubber

Cardboard boxes ontop of rubber are more difficult to shift or push out from under the straps.

Not Secure Enough

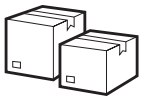
When two or more packages are stacked on top of each other, it is easy to push them out from underneath the straps.

Retractable Straps

Straps that can retract on their own will ensure the package is properly secured in a timely manner.

Adding steel wire or cable makes it difficult to cut straps with knives.

The straps hide underneath the doormat when not in use.



Strap system can hold multiple packages.

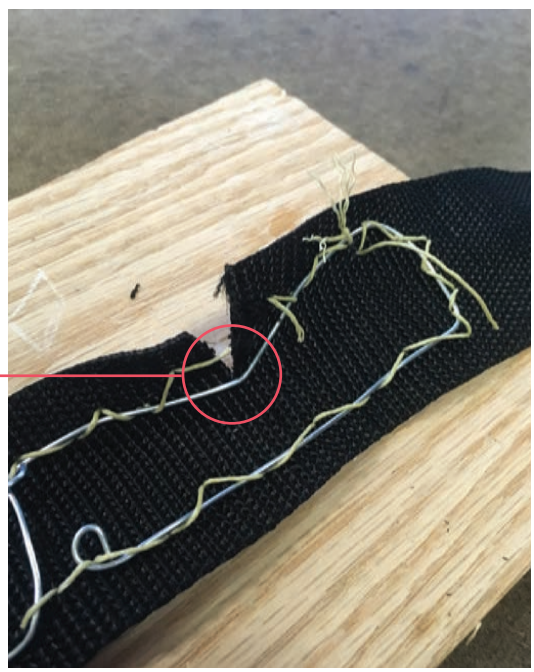
Steel Straps

We needed to find a strap material that would be difficult to cut through, or a way to reinforce the material. We stitched steel wire into ribbed nylon straps to see how difficult it would be to cut.

Even though you can cut steel wire with wire cutters or scissors, using it in the strap makes it difficult to cut with a knife.

KanuLock

KanuLock is an existing product that uses steel cables in straps to secure canoes to the top of cars.

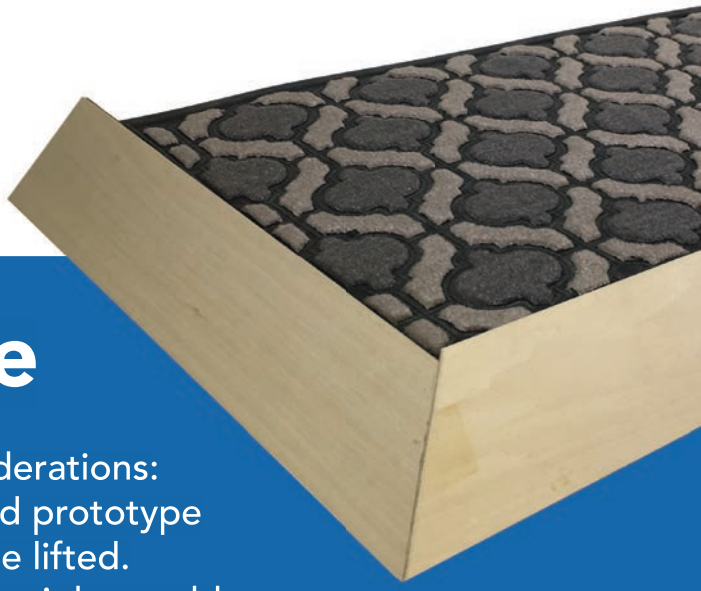


Knife Unable to Cut Through

- Without the steel wire stitched into the strap, a knife can easily cut through
- With the steel wire the knife is unable to gain enough momentum to cut through.

Beveled edge makes it difficult to lift with finger strength alone.

Beveled edge is a small design detail that does not take up additional space.



Beveled Edge

The beveled edge is designed to prevent anyone from easily lifting the entire system. Angled sides that are flush to the ground make it difficult to get your fingers underneath to lift.

Further Considerations:

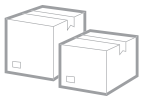
- The 7 pound prototype could still be lifted.
- Additional weight would increase the difficulty in lifting the system with additional tools like crowbars.

Finger-Strength

- The beveled edge makes it difficult to pry your fingers underneath to lift with your whole hand.
- This prototype was not perfectly flush with the ground so it was easier to reach your hand underneath and lift.

Beveled edge with about 50 pounds of weight cannot be lifted with finger-strength alone.

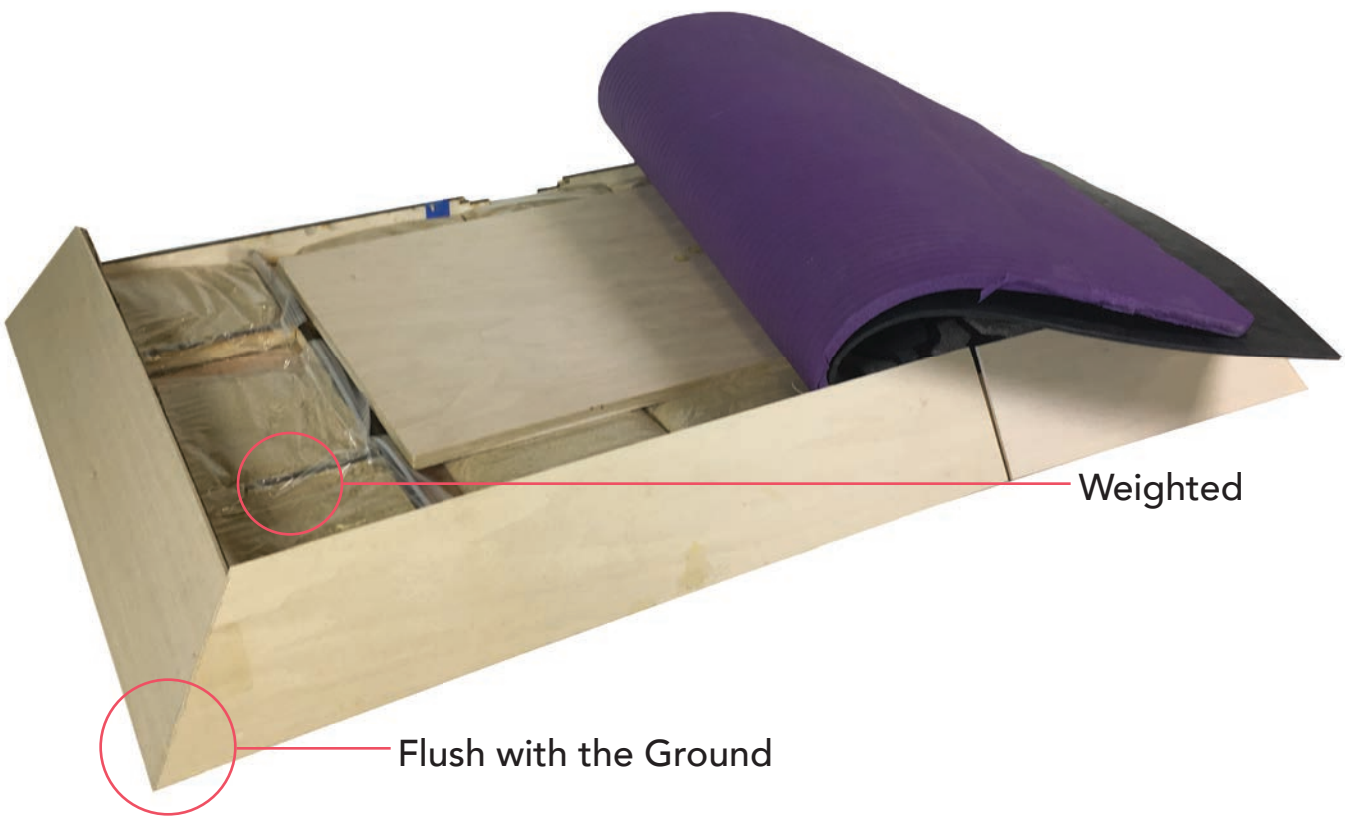
Design features are disguised as part of the doormat.

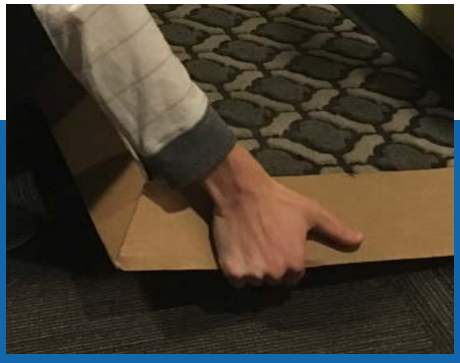


Weight + Beveled Edge

A combination of weighting the system and beveled edges that are flush with the ground prevented the system from being lifted.

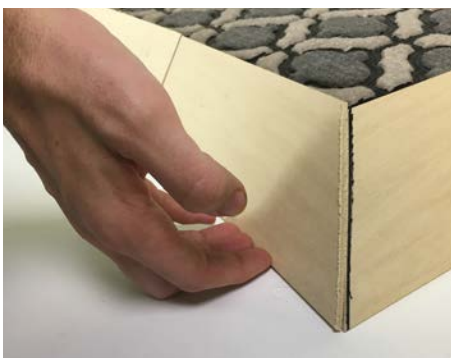
The beveled edge is flush with the ground and makes it difficult to get a good grasp on the system. The weight makes it difficult to lift the sytem enough to get your fingers underneath.





10 Pounds

- Ten pounds of weight was not enough to prevent some people from lifting the system.
- The first prototype used cardboard for the beveled edge. The edges were not flush with the ground and could be bent so we did not get an accurate test of the design.

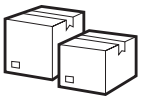


50 Pounds

- Fifty pounds of weight combined with the beveled edge could not be lifted by multiple test subjects.
- The beveled edge in this prototype was made with wood sanded at the bottom. The flush edges prevented people from prying their fingers underneath to lift the system.

Kevlar material is difficult to cut through or remove packages from underneath.

Material can be rolled up and stored under doormat when not in use.



Blanket-like design can secure multiple packages at once.

The retractable design makes it easier for a courier to deploy.

Blanket Style - Kevlar

The strap system was too easy to push aside to remove packages so we tried different materials to cover the packages like a blanket.

Further Considerations:

- The kevlar material hugs the corners of the box well.
- The kevlar material was hard to cut but easily frayed without the resin.

Corners Protected

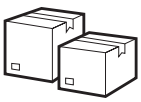
The weave of the kevlar is able to tighten around the corners. This makes it difficult to try to push the packages out from under the kevlar material.

Material Choice

Kevlar is difficult to cut through without being coated in resin. However, the material is easily frayed and punctured.

Netting material is easy to cut, need to find better material.

When not in use, the netting material is stored beneath the doormat, out of sight.



The amount of packages is limited by how far the net can stretch.

The net is easily deployed by a courier and locked on the top.

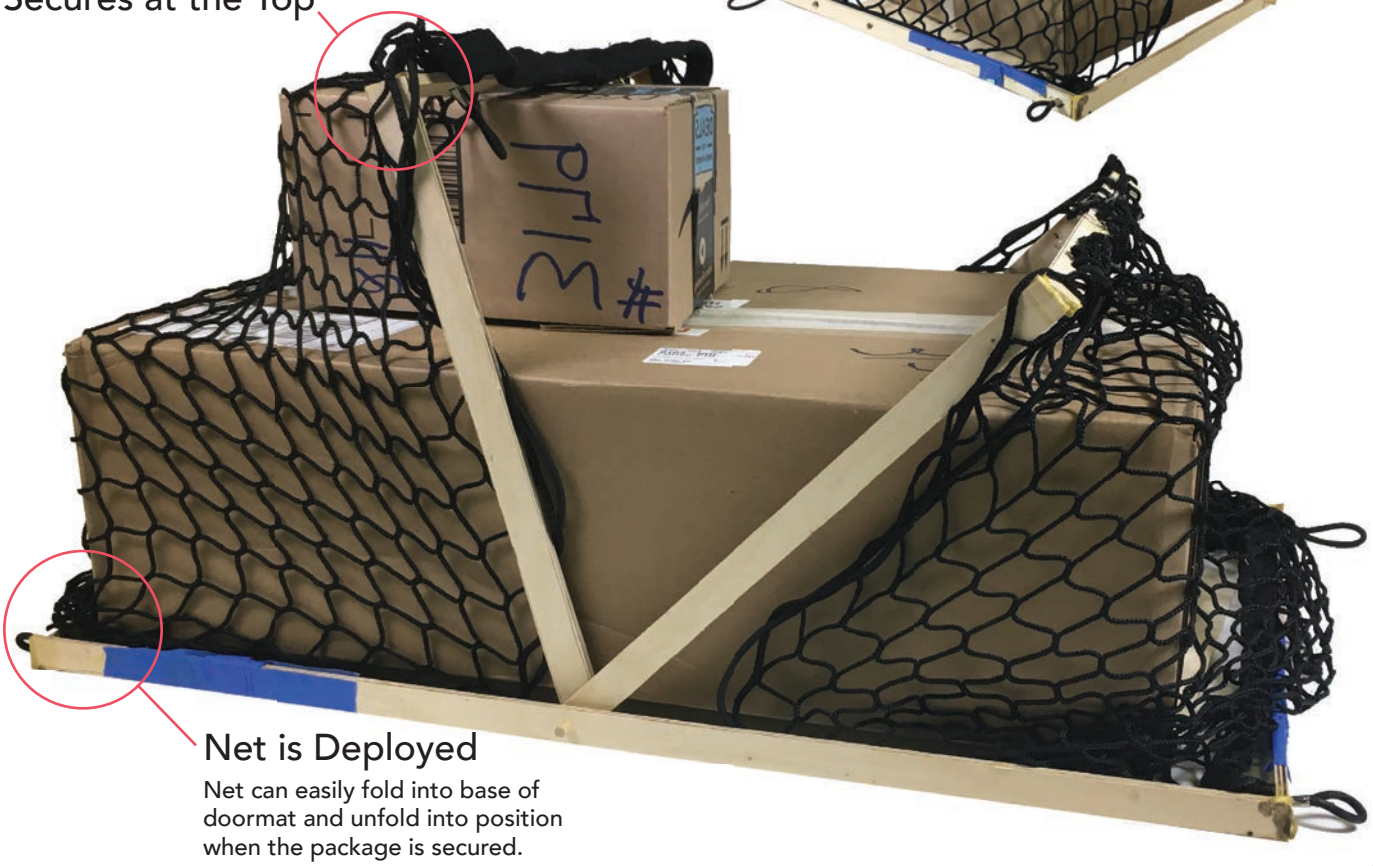
Netting Bear Trap

The idea for this design iteration came from how bear traps spring up from the ground. The problem with this design is that it limits how high the packages could stack.

Further Considerations:

- How can the ergonimics of deploying the net be easier for the courier?

Secures at the Top

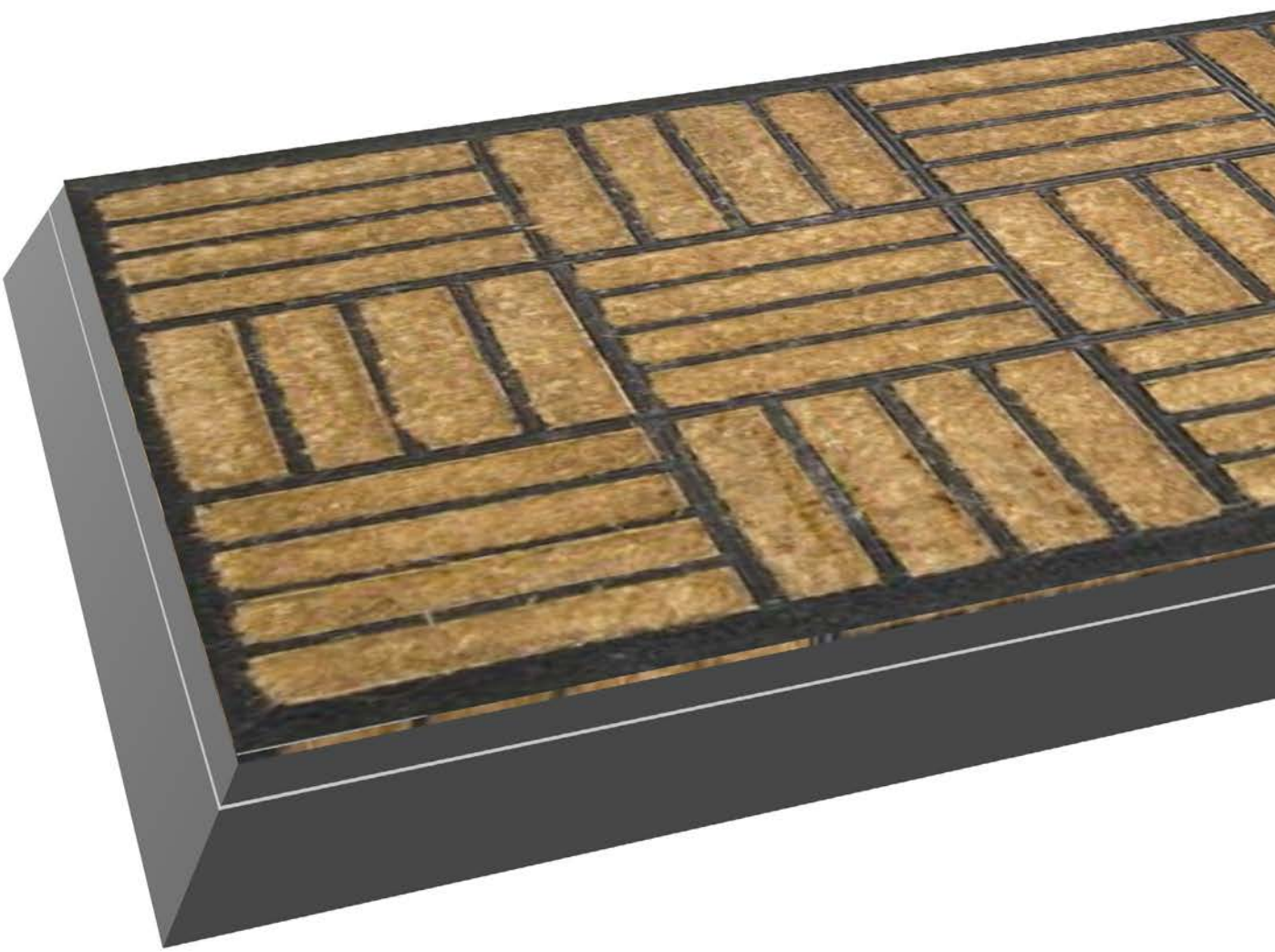


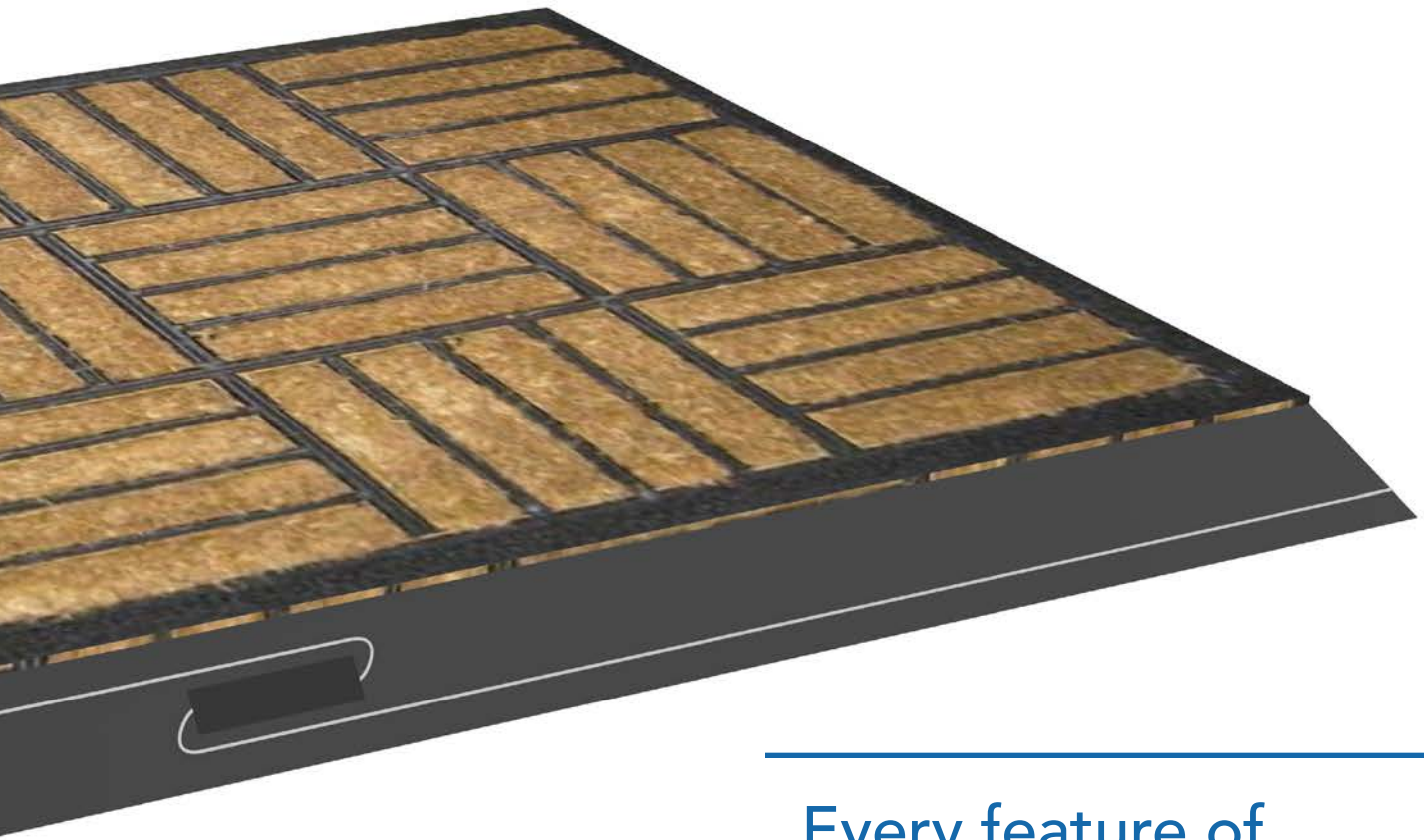
Net is Deployed

Net can easily fold into base of doormat and unfold into position when the package is secured.

05

final design





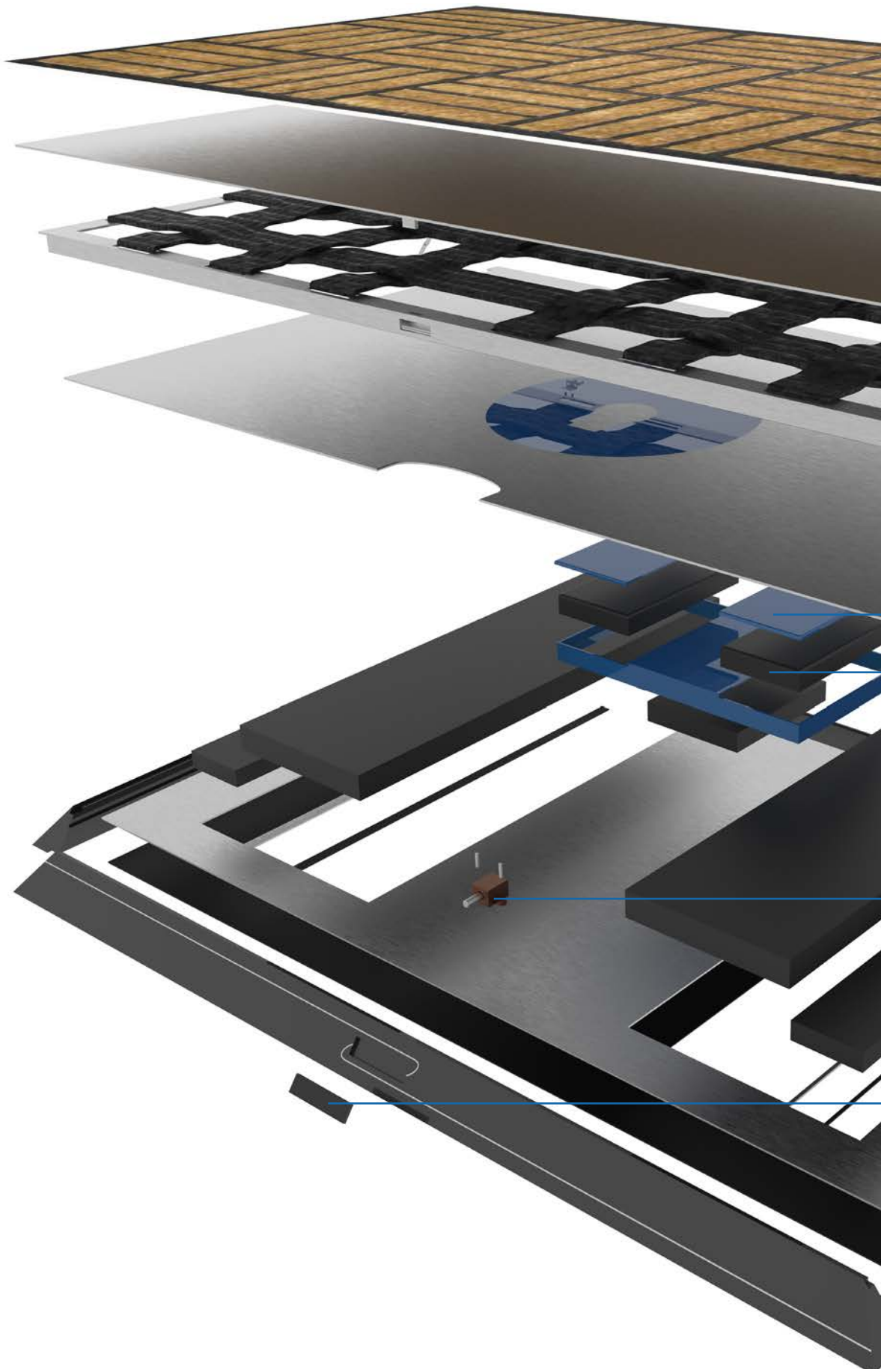
Every feature of the final design was informed by what we learned from prototyping

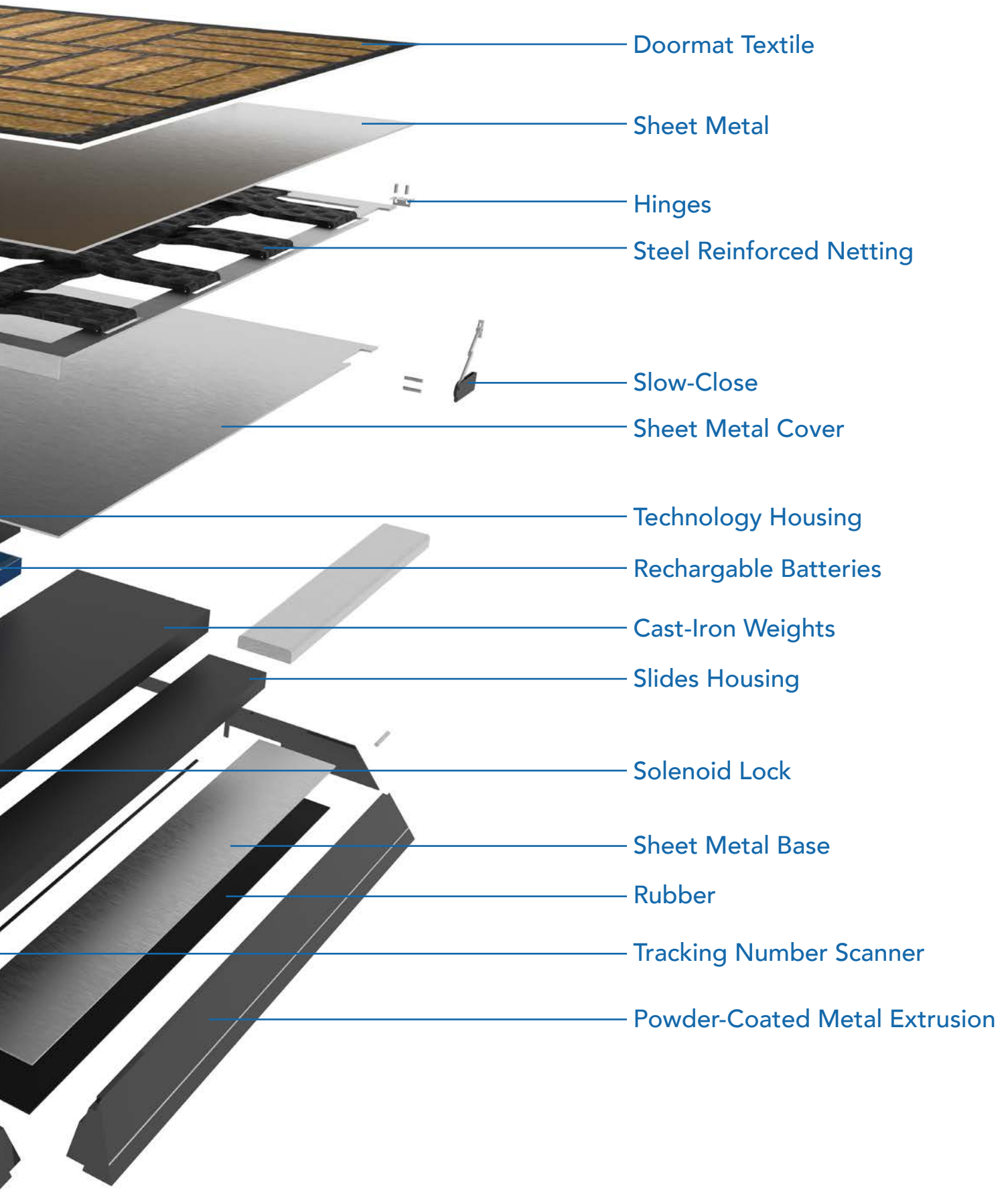

67

When not in use, SafeShip is a funcitonal doormat.


67
safe and secured
amazon

Once a package is delivered, SafeShip acts as a theft deterrent until the homeowner returns home.



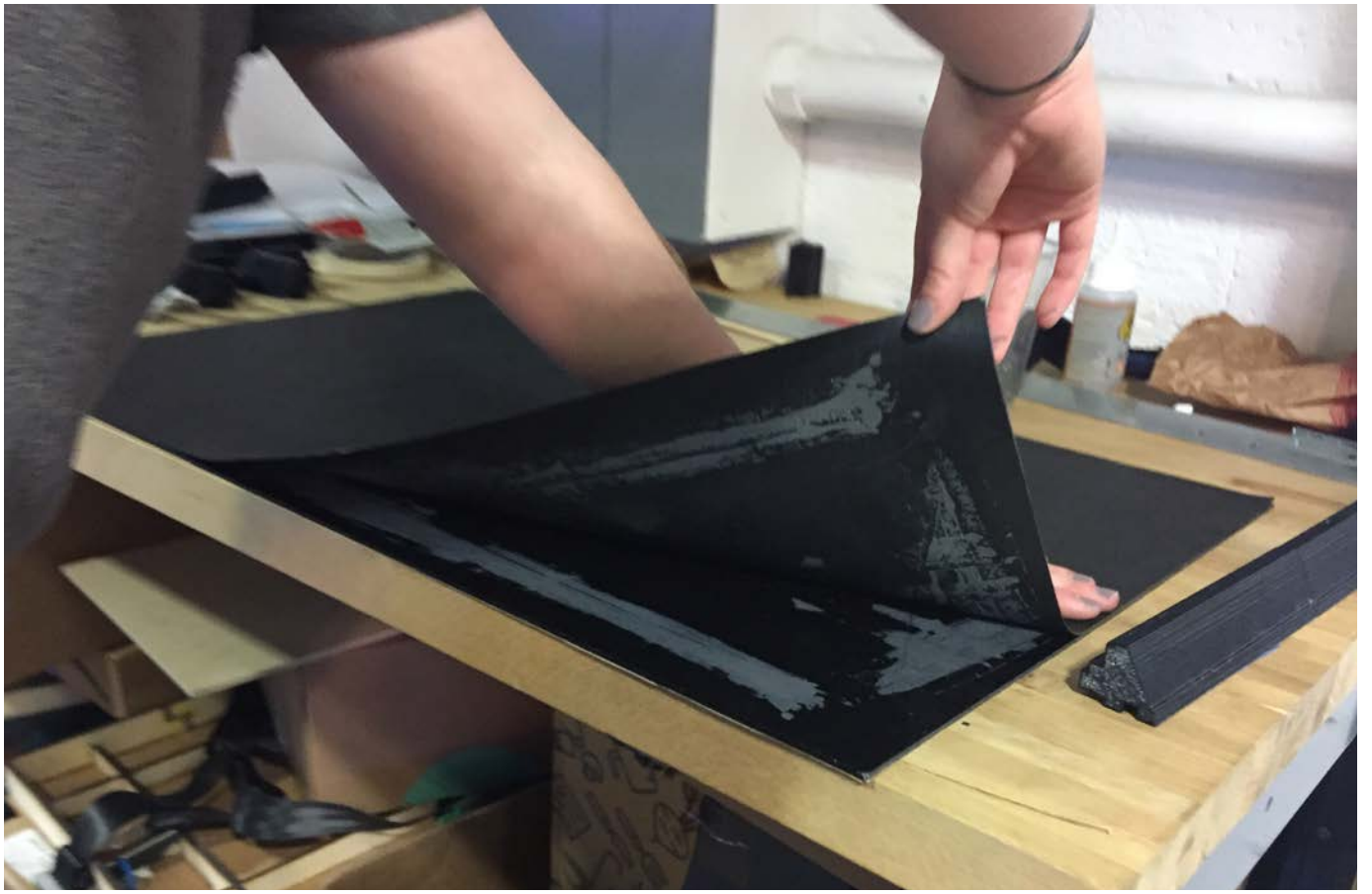

Doormat Textile
Sheet Metal
Hinges
Steel Reinforced Netting
Slow-Close
Sheet Metal Cover
Technology Housing
Rechargable Batteries
Cast-Iron Weights
Slides Housing
Solenoid Lock
Sheet Metal Base
Rubber
Tracking Number Scanner
Powder-Coated Metal Extrusion

06

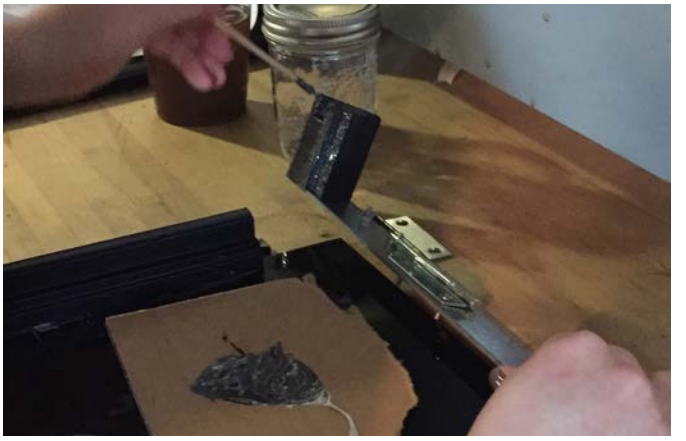
final model

Constructing Final Model

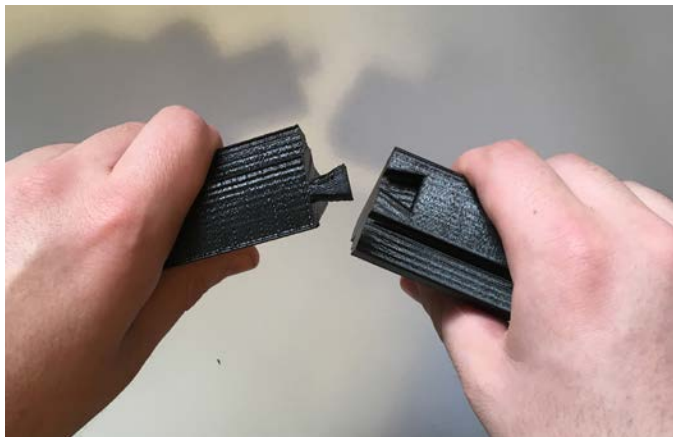
We designed cut sheets with Fusion 360. Used a waterjet to cut 16 gauge steel. Special thanks to our friends at Lostine for providing the steel and lending their waterjet cutter.



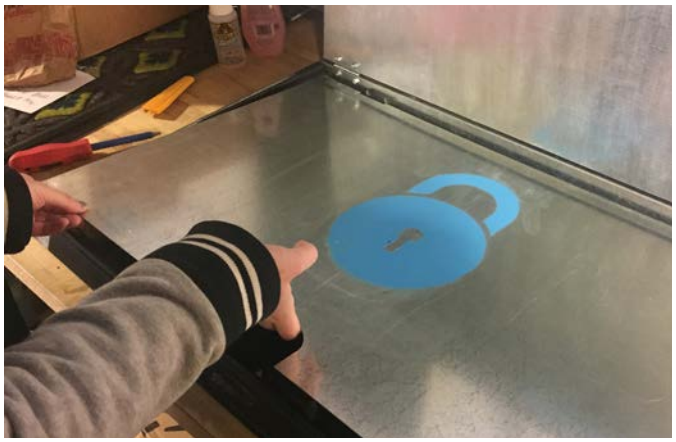
We used epoxy to secure rubber to the bottom and the edges to the acrylic.

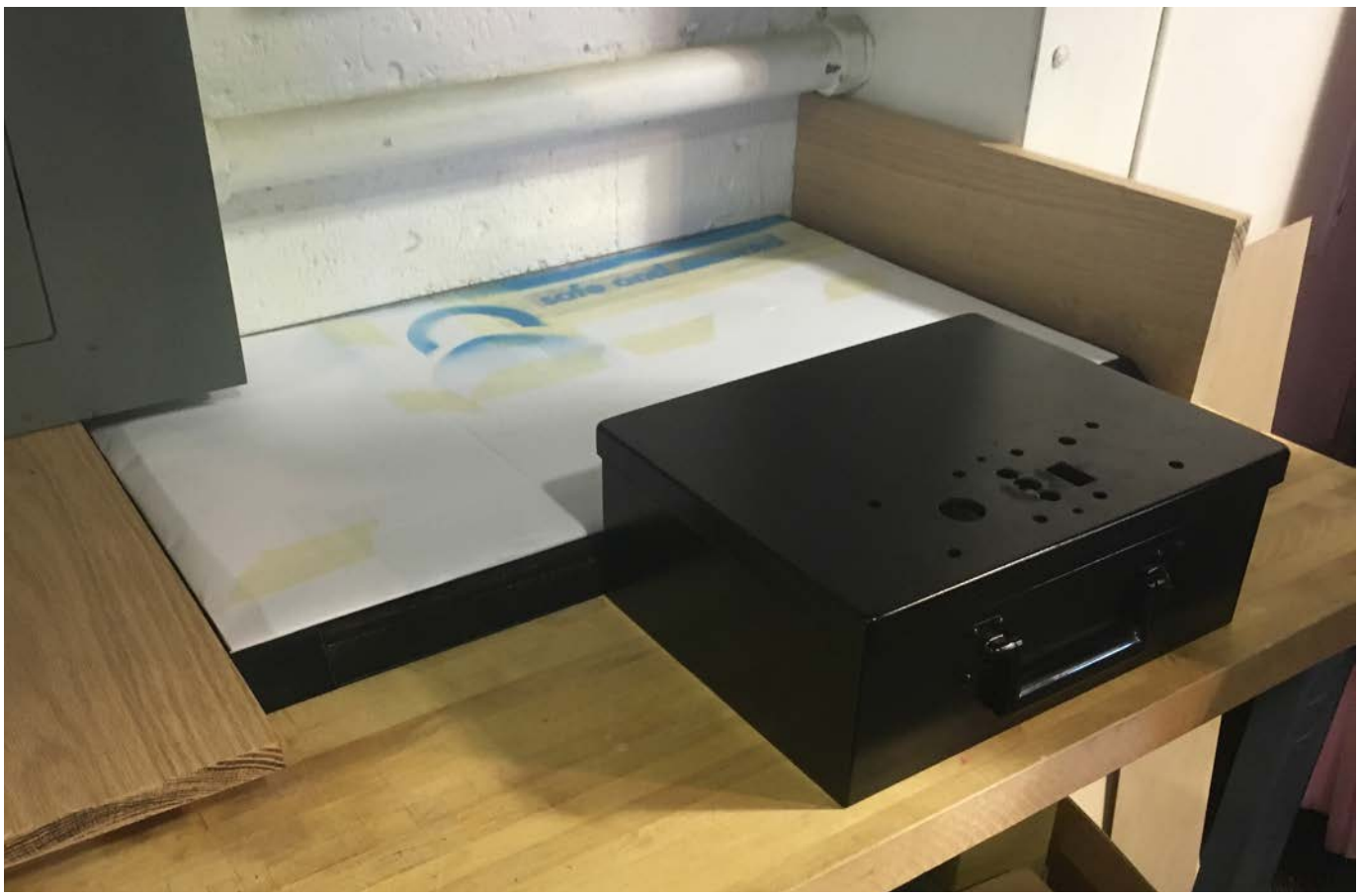


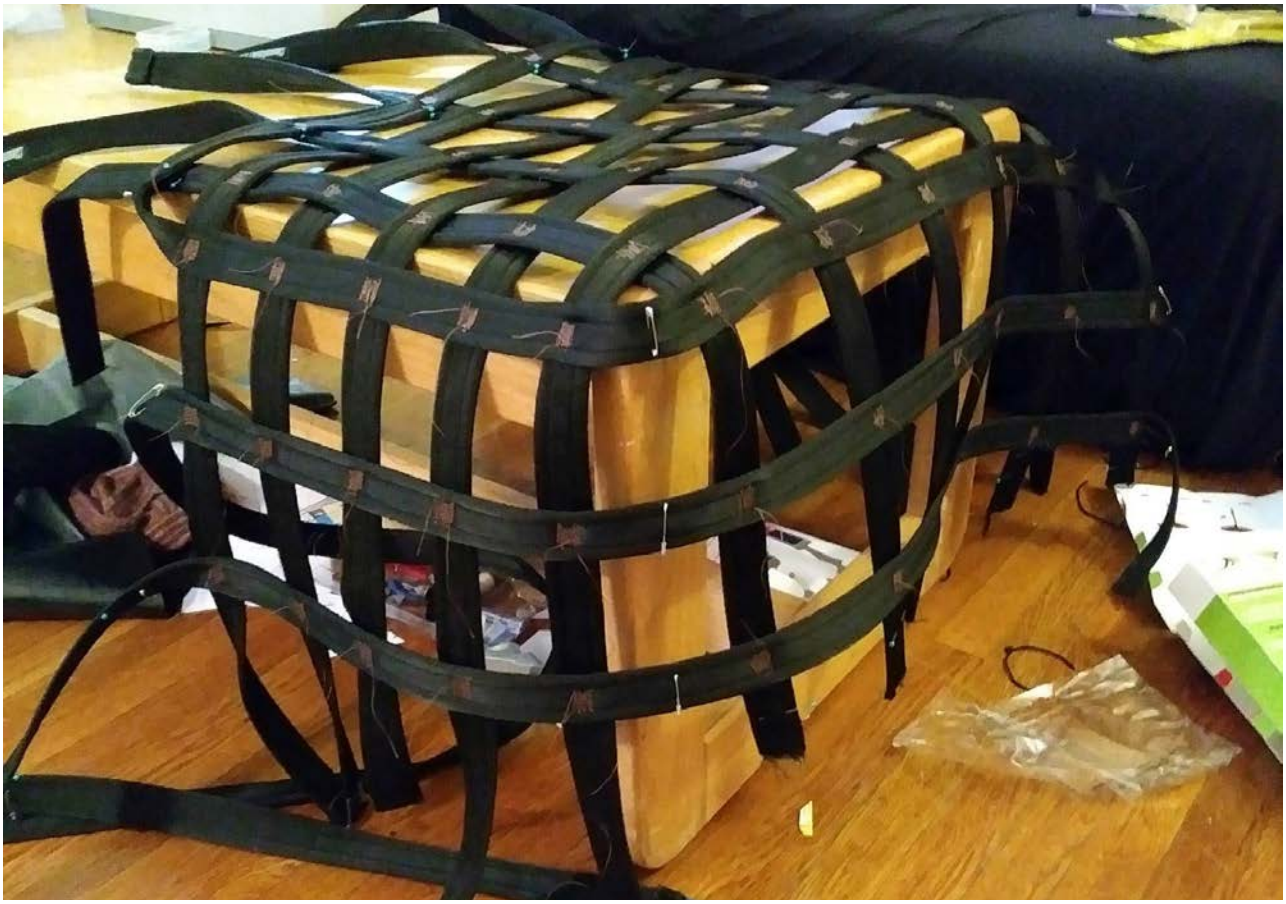
The beveled edge was 3D printed. We tested multiple size tolerances to get the best fit.

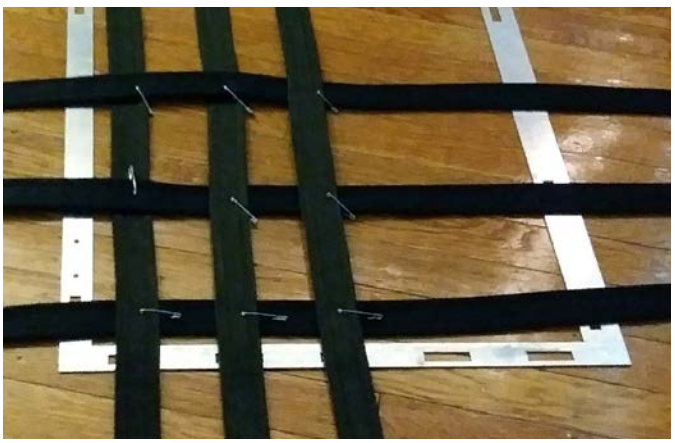


The beveled edges prevented clamps from getting a good hold on the edges. We improvised by putting pressure on the edges of the model to help the epoxy set properly.





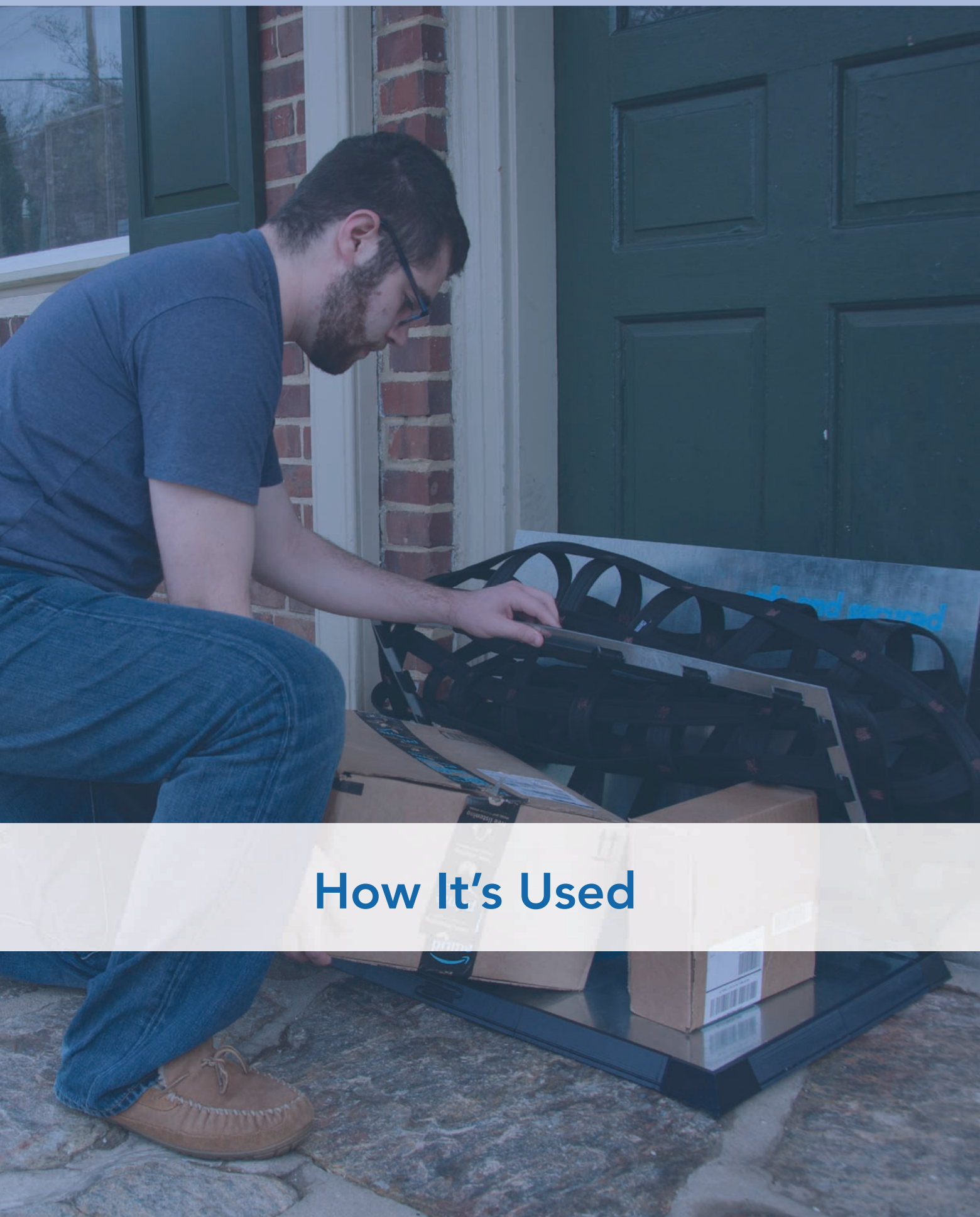




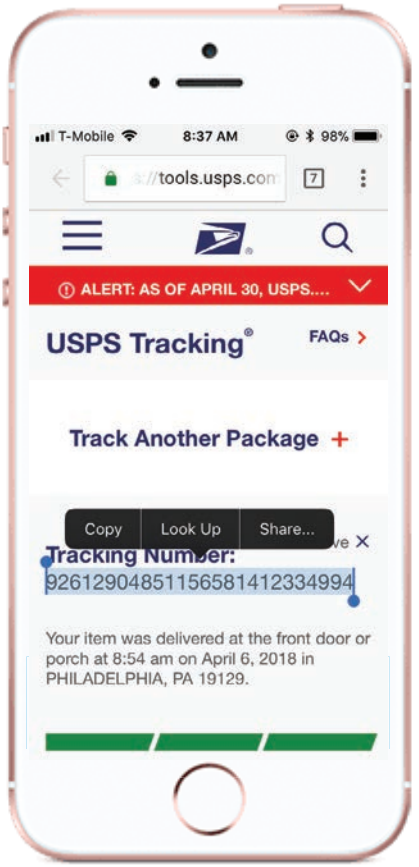
We used Kanulock Straps to create the net. Cut the steel cables with cable cutters and stitched the net into the frame. Special thanks to Angela Villanueva for her help during this process.

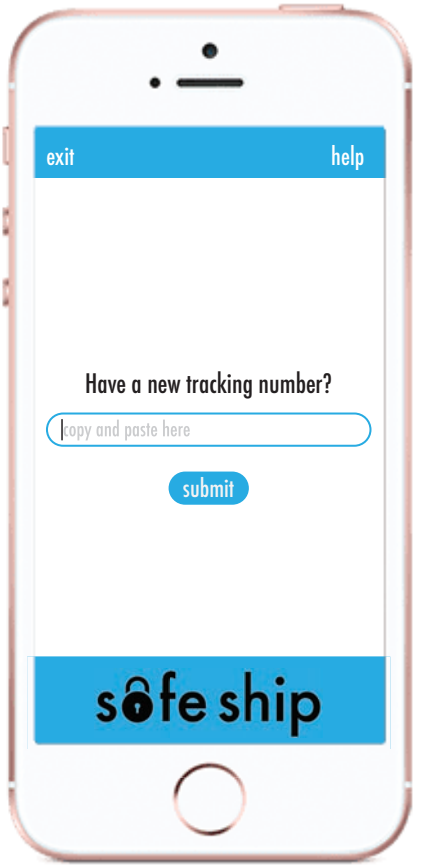
07

design criteria



How It's Used





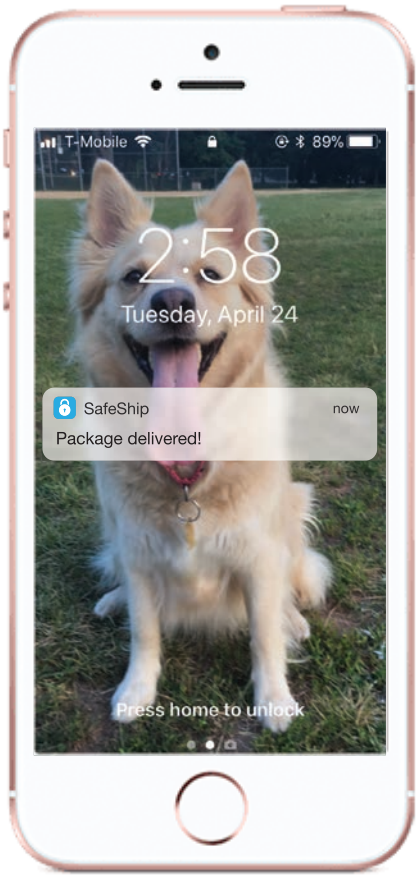
Process begins with the mobile app. When an order is placed online the tracking number information is copied and pasted into the SafeShip app. This communicates to the doormat what tracking numbers to expect.

Courier arrives to the front step as usual.

The tracking number is scanned on the front of the mat.

The doormat lid pops open.

The courier lifts the lid and net to place the package.



The net is closed and locked into place. The homeowner recieves a notification that their package has been delivered.

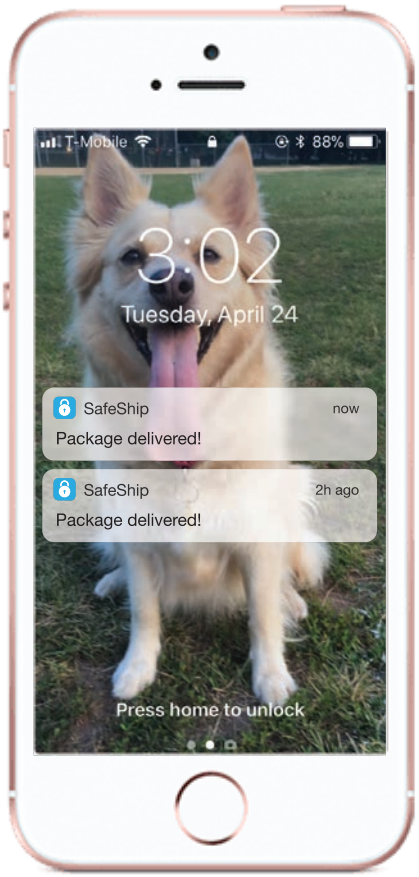

spPBHH2XKMW

SafeShip is prepared for multiple deliveries in a single day.


spPBHH2XKMW

The tracking number is scanned to unlock the net.


prime
prime



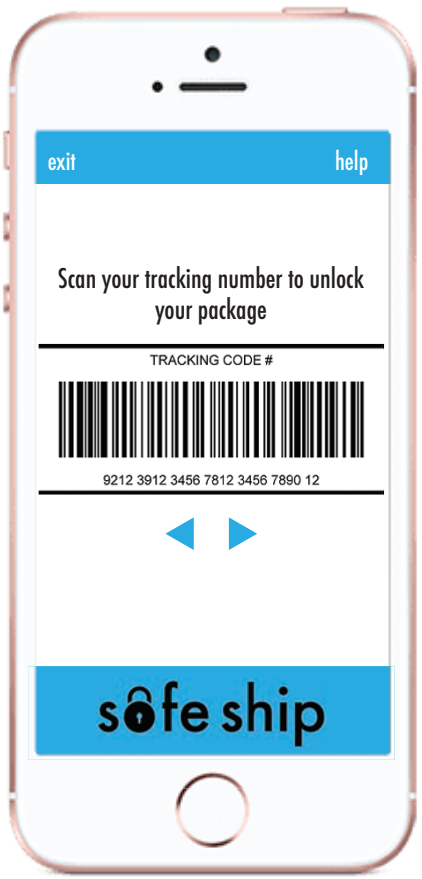
The net is lifted and another package can be delivered.

It will take time to cut a large enough opening in the steel reinforced net.

The weighted base and beveled edge makes it difficult to lift up the entire doormat.

If the net is pulled an alarm will sound.

A thief is better off finding an easier target.



When the homeowner arrives home they scan their phone app to unlock the net.


prime
prime

The net is unlocked and the packages are successfully delivered.

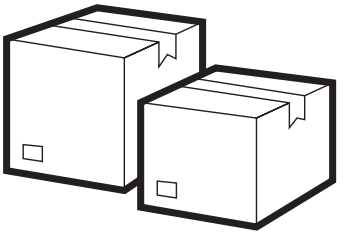
The homeowner closes the net and the lid.

SafeShip is prepared for another delivery.

The Features

Deters Theft

Unobtrusive Design



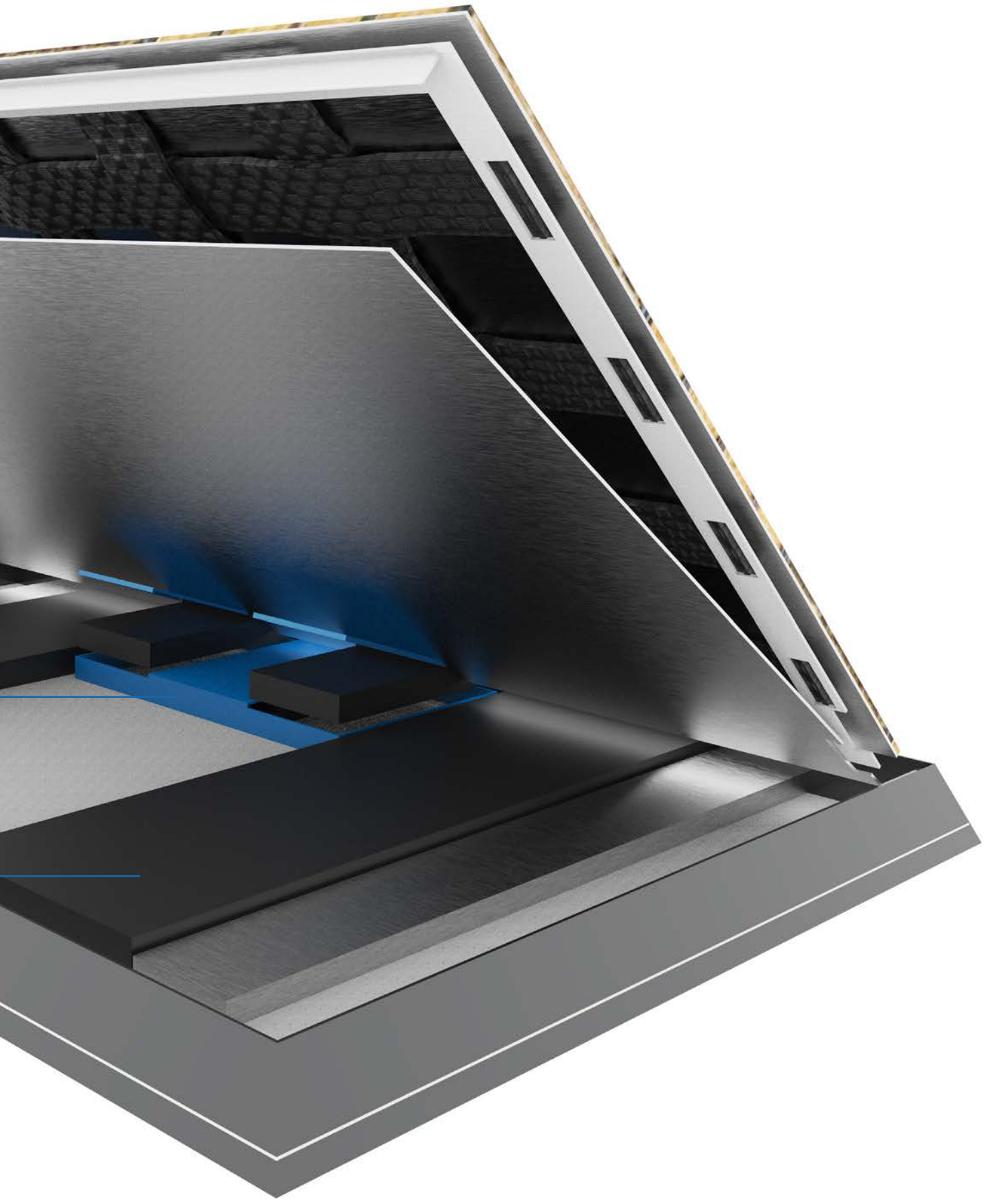
Accepts Multiple Deliveries

Intuitive to Use

Deters Theft


safe and secured
azon

Deters Theft



Unobtrusive Design

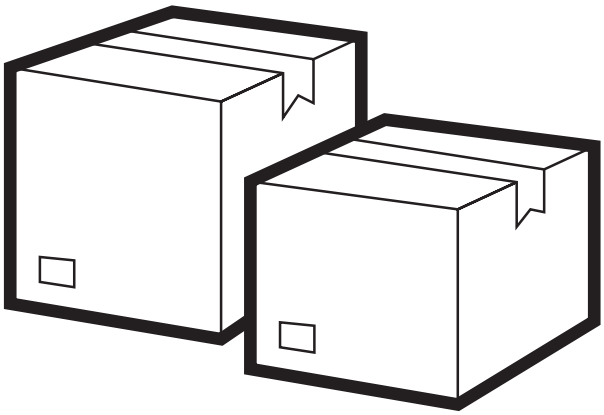
Interchangable Textiles

Doormat Form

Beveled Edge

Extruded Design Indicator


HELLO
OR TREAT
Christmas
THE MONAHANS



Accepts Multiple Deliveries

Tracking Number Scanner


safe and secured
amazon

Intuitive to Use


T-Mobile
88%
3:02
Tuesday, April 24
SafeShip
now
Package delivered!
SafeShip
2h ago
Package delivered!
Press home to unlock
T-Mobile
89%
2:58
Tuesday, April 24
SafeShip
now
Battery Low
Press home to unlock


safe and secured

Thank you

Eileen Martinson and the Martinson Fund
James Siminoff
John Modestine
Bob O'Leary
Todd Kramer
Mark Havens
Mike Leonard
Tod Corlett
Angela Villanueva
Alex Marino
Ryan Bukovsky
The Industrial Design Class of 2018