



RecyclAir

AMIR ARDALAN, CONOR HARRINGTON,
HOUSTON HOOVER, JACK MCKEEHAN,
JOSH PICCOLI, CHAN STAPLES

The Problem

In 2014, commercial airlines in the United States disposed more than 200,000 tons of in-flight waste. Of this waste, 25-35% could have been recycled, but was thrown away because of a lack of adequate recycling programs and management of recyclables.



Current State of Airline Recycling



*"The current state of in flight recycling at airlines is **almost non-existent**. A system has not been designed or implemented to properly handle recycling".*

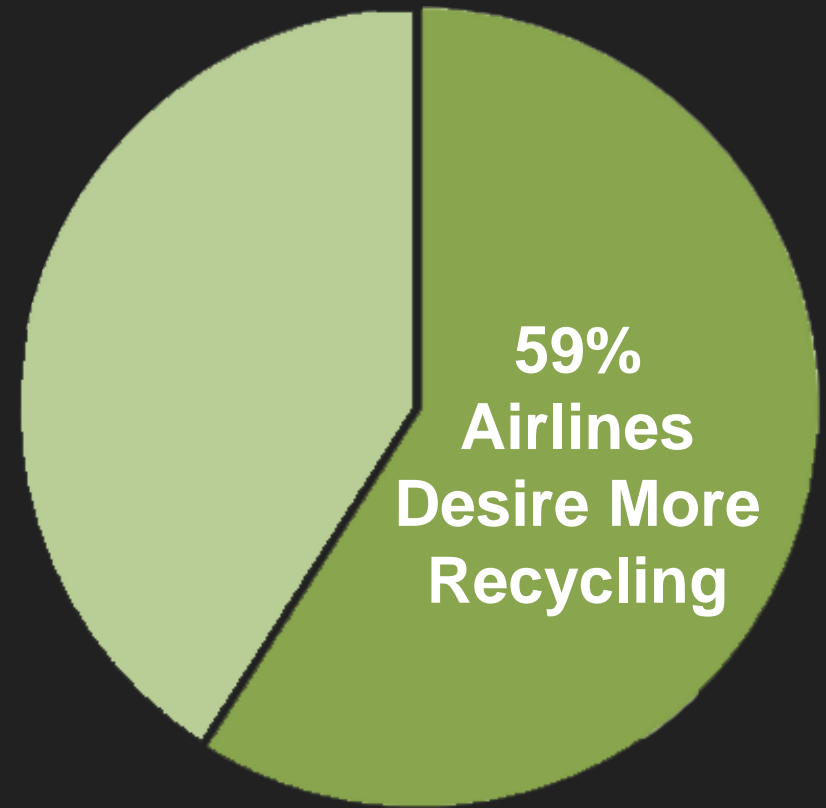
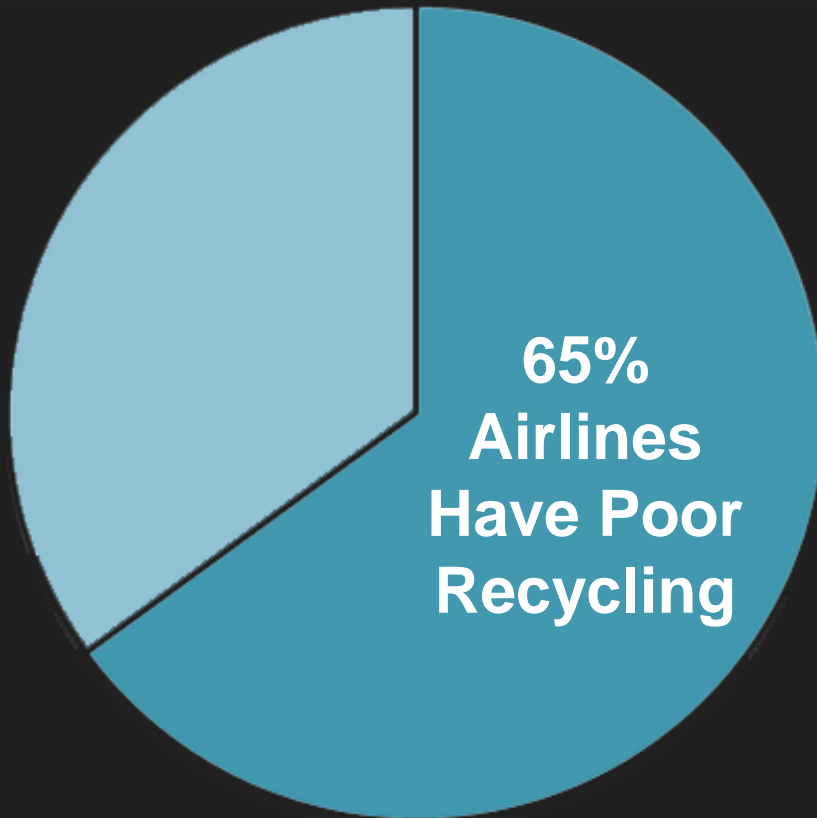


-Marlea Hodgkin

American Airlines (20+ years)

February 2016

Survey of Airline Recycling



Current Airline Systems

The Southwest logo features the word "Southwest" in a blue, sans-serif font, followed by a stylized heart icon composed of red, yellow, and blue segments.

Third party company collects all waste and sorts it for profit

The American Airlines logo consists of the words "American Airlines" in a black, sans-serif font, followed by a stylized eagle head icon in blue and red.

Flight Attendants sort trash from recyclable

The Qantas logo features a stylized kangaroo in red, with the word "QANTAS" in a red, sans-serif font to its right.

Each passenger has a separate recycling bag

The Delta logo features a stylized red triangle with a white outline, followed by the word "DELTA" in a blue, sans-serif font.

Cabin services collect recyclables in separate plastic bags

Existing Product Solutions



Trash Bags

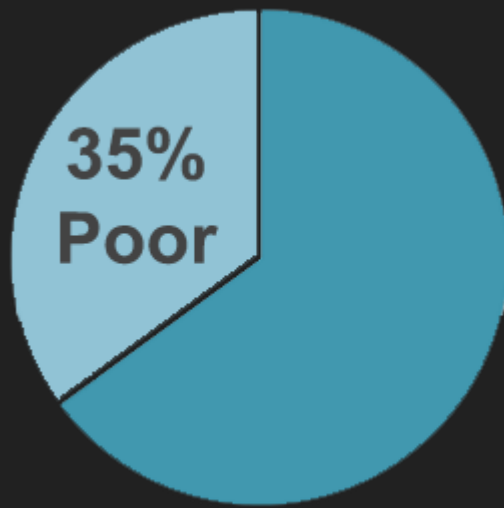


Qantas Airlines Recycling Bag

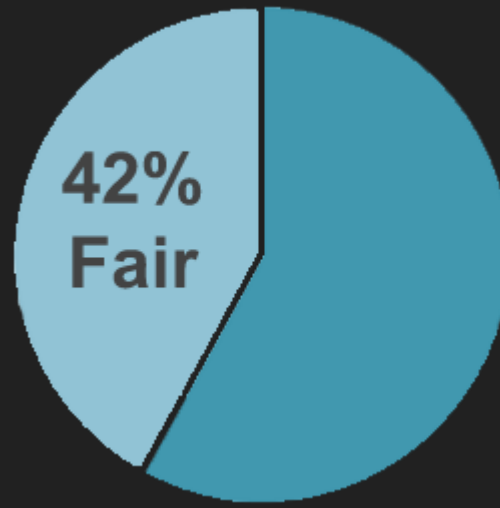
Statement of Purpose



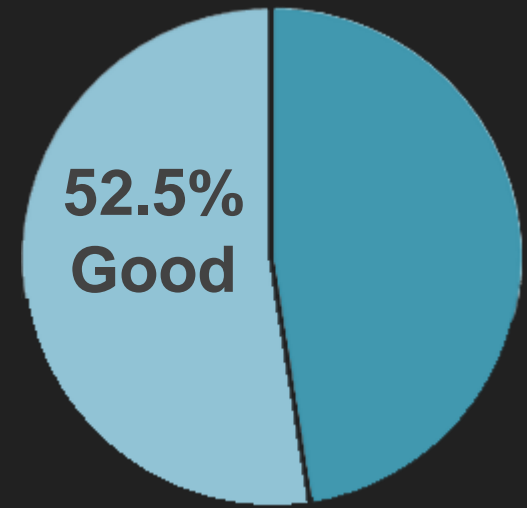
To design an airline recycling system & product that will increase the rate of recycling by 50% over 2 years.



Today

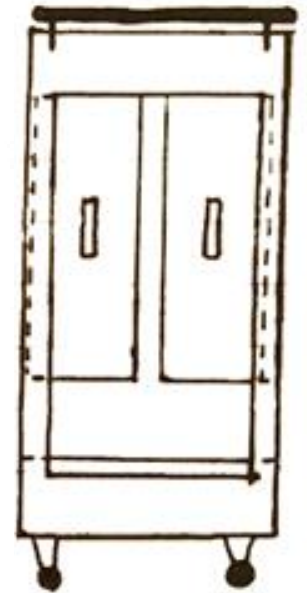
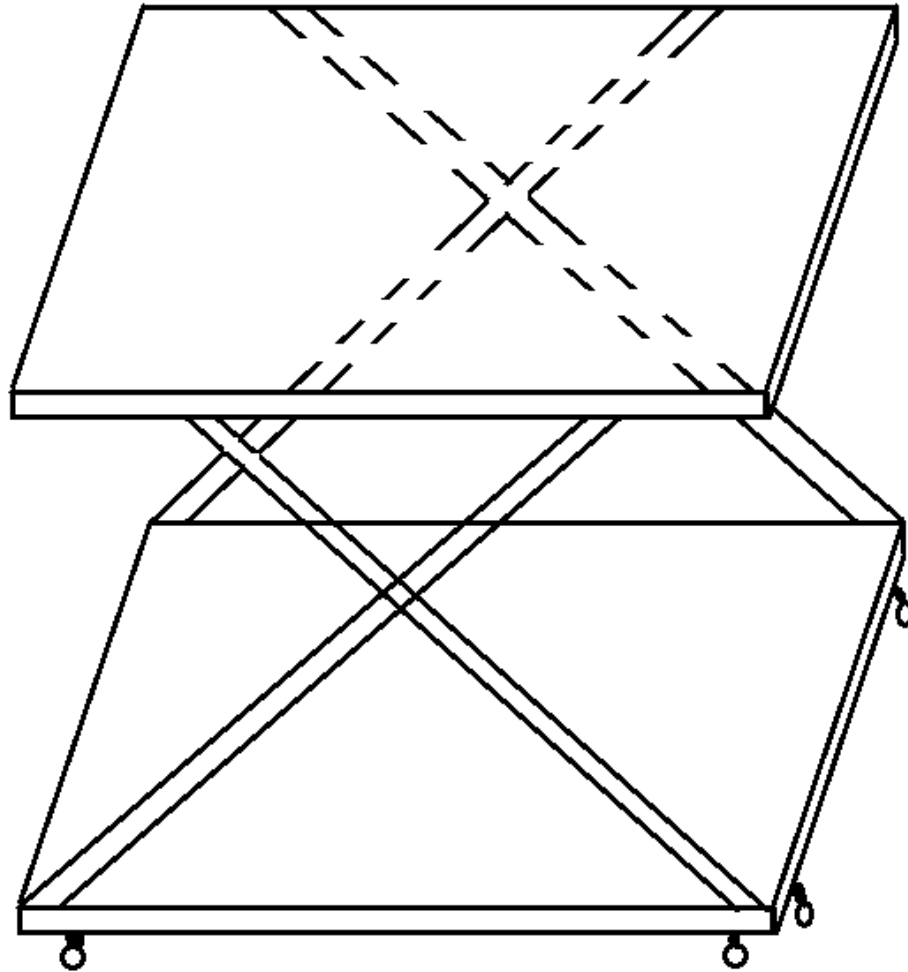
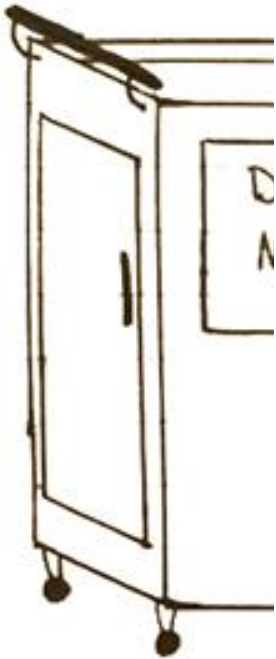


1 year



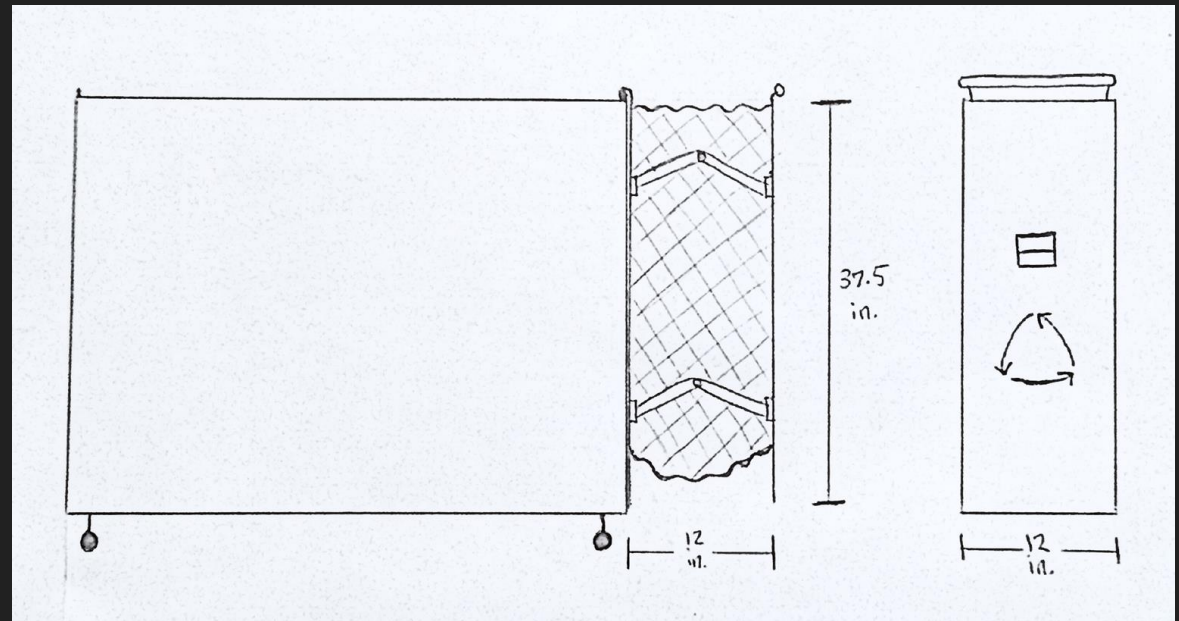
2 years

Alternative Designs



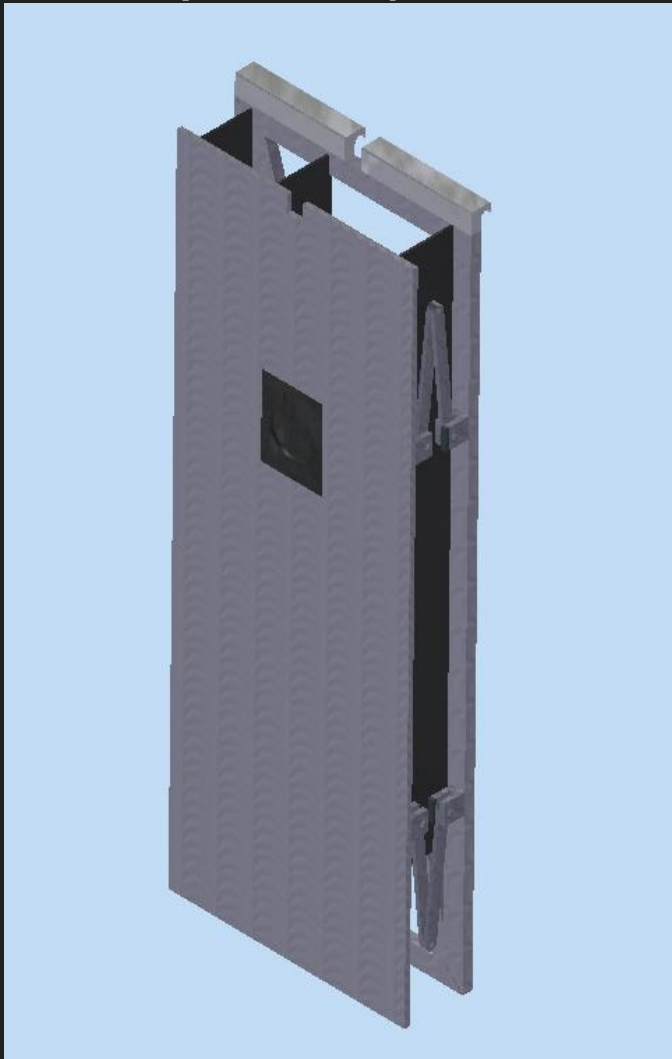
RecyclAir Attachment Design

- Collect & Separate
- Cost Effective
- Produces Profit
- Ergonomic
- Easy to Use
- Lightweight
- Fits in Aircraft

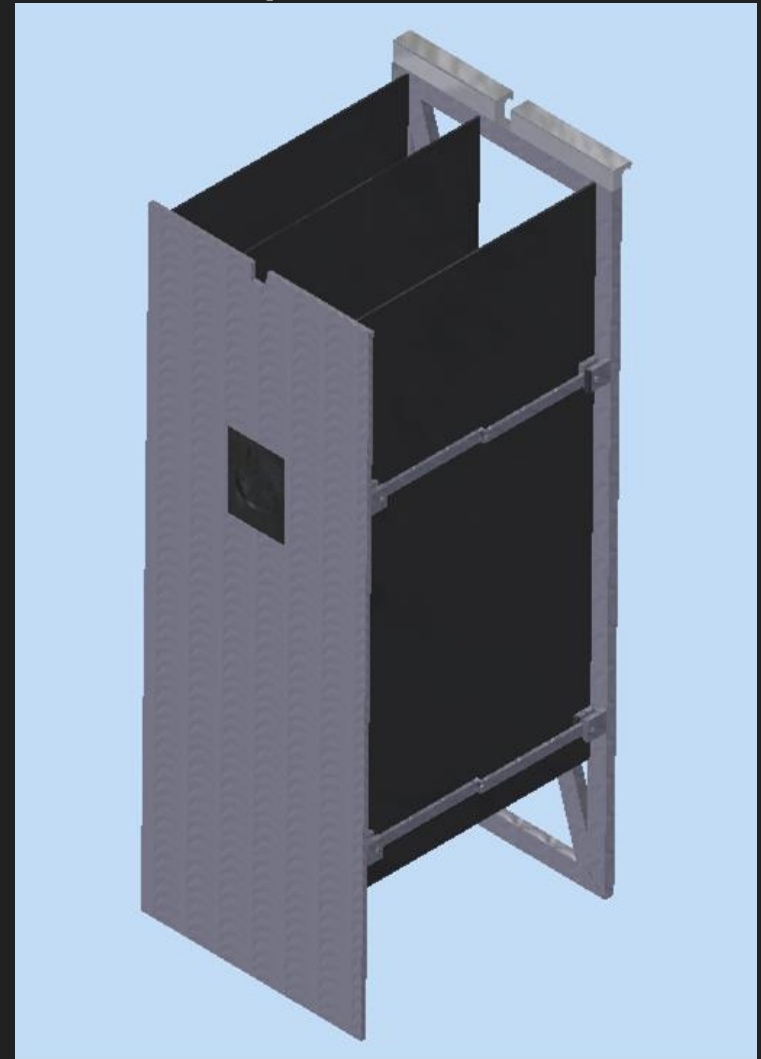


Design Rendering

Fully Compacted



Fully Extended



Design Iteration

1.0



1.1 New Handle 1.2 Increased Volume



Working Model Prototype



Professional Feedback

"I think the design is excellent in that it:

- 1) Adapts to existing equipment
- 2) Is cost effective
- 3) Can provide the flexibility to separate on the fly."

-Doug Southall

Gate Gourmet



Testing

Tests	Iterations		
	1.0	1.1 New Handle	1.2 Larger Volume
Aisle Maneuverability	PASS	PASS	PASS
Sustained Weight	FAIL Capacity limitation	FAIL Capacity limitation	PASS
Ease of Use	FAIL Intrusive handle	PASS	PASS
Stress	PASS	PASS	PASS
Cost	FAIL \$\$\$	PASS	PASS

Airline Recycling System

Aircraft
Phase

- Collect
- Separate
- Remove

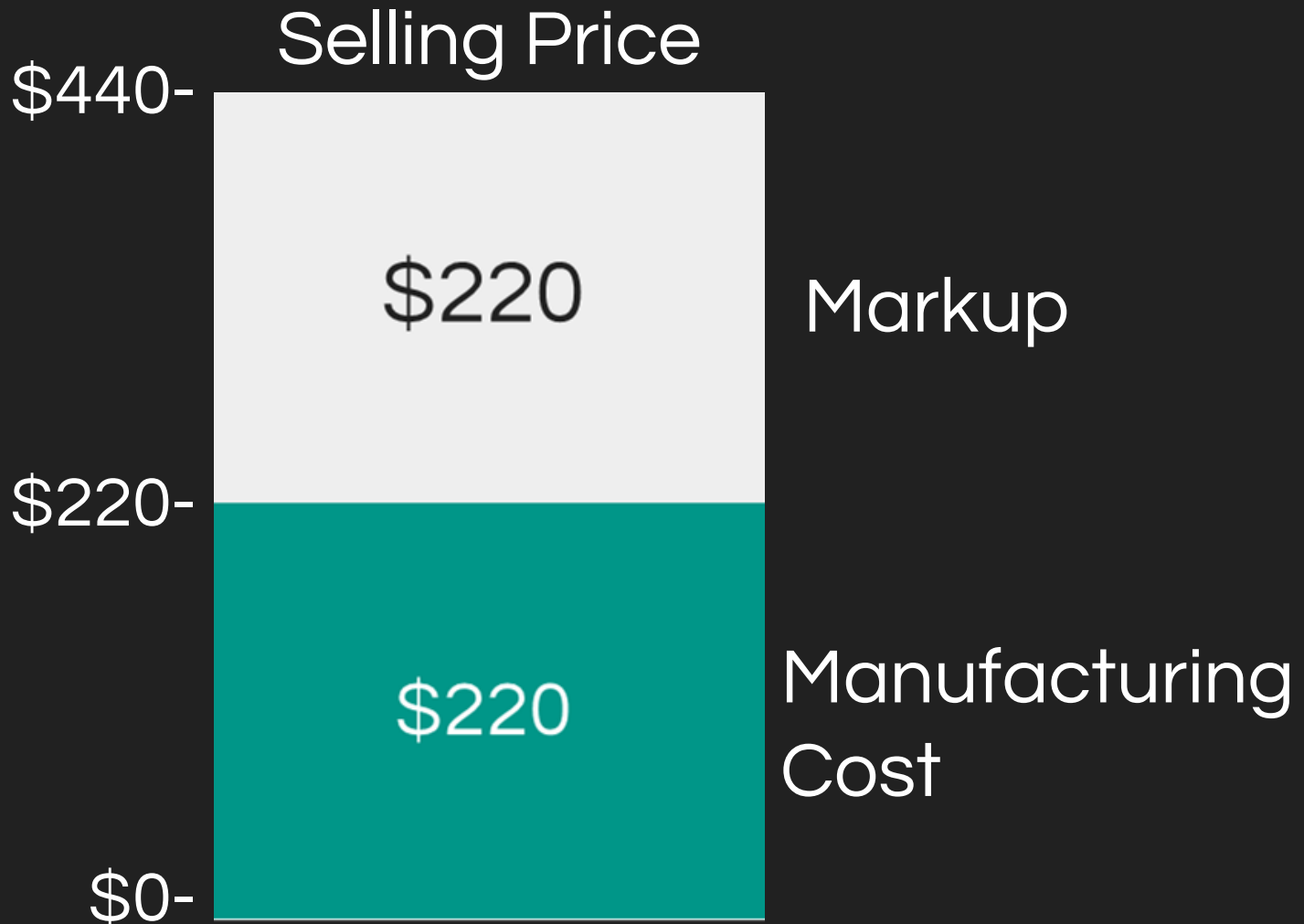
Airport
Phase

- Collect
- Sell
- Dispose

Third
Party

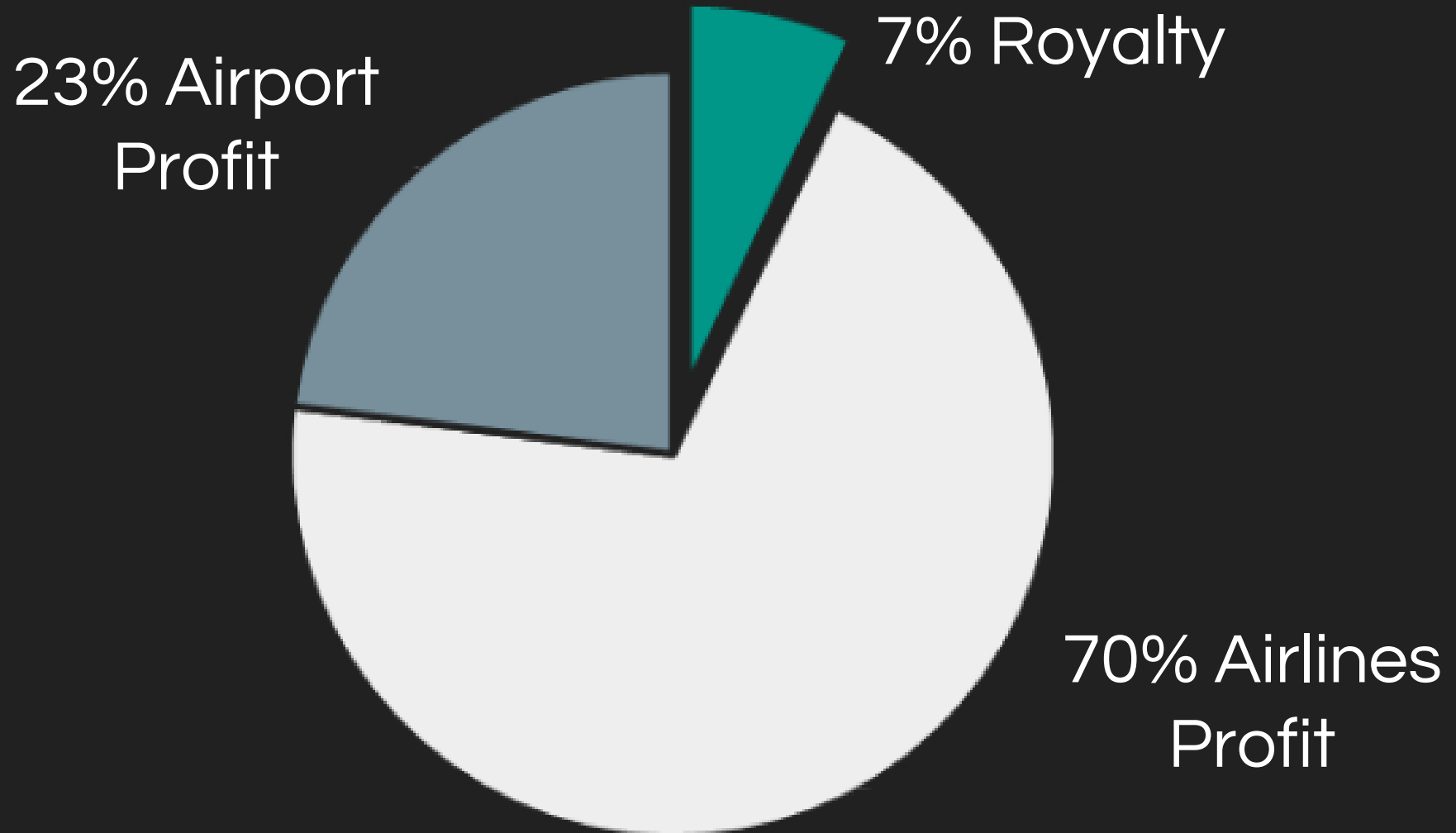
- Purchase
- Recycle
- Sell

Product Cost and Pricing



System Profit Breakdown

Income from Recyclables: \$910,000 annually



Looking Ahead...

- Fabricate prototype
- FAA certification
 - Additional Stress Test
 - Flammability test
- Research attachment storage in galley
- Capitalize on other potential markets

Thank You

Instructors and Mentors

Steve Cahoon

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Mike Mahon

Carl Hoover

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Air Canada

Chelsea Quirke

Guy Padova

Penny Thompson

Sun Country Airlines

Betsy Jones

Jetblue Airways

Virgin America

Hawaiian Air

United Airlines

Dale Chase

Southwest Airlines

Delta Airlines

Jerry Samuels

Gate Gourmet

Doug Southall

Oscar Asencio

LSG Sky Chefs

Joe Gallagher

SaLUT Corrosion

John Smith

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Size & Weight - Dimensions

Width:

Max: .381 meters (15 in)

Height:

Max: 1.22 meters (48 in)

Weight:

Empty Max: 27.67 kg (61 lbs)

Full Max: 65.66 kg (144.75lbs)

Ergonomics

Easily utilized/handled

Less than 225 N of force to operate

Able to be pushed down aisle

Design Matrix

Ideas by Rank	Rank
Improved Cart	95
Funnel Bin	94
Rack Cart	94
Open Air Cart	93
Bagless Separate Bin	91
Recycling Frame	88
App	88
Sticker/Logo	85
Tablet Cart	84
Disposal Station	72
Airline Recycling 2.0	93
Air Recycling System	90

Potential Market

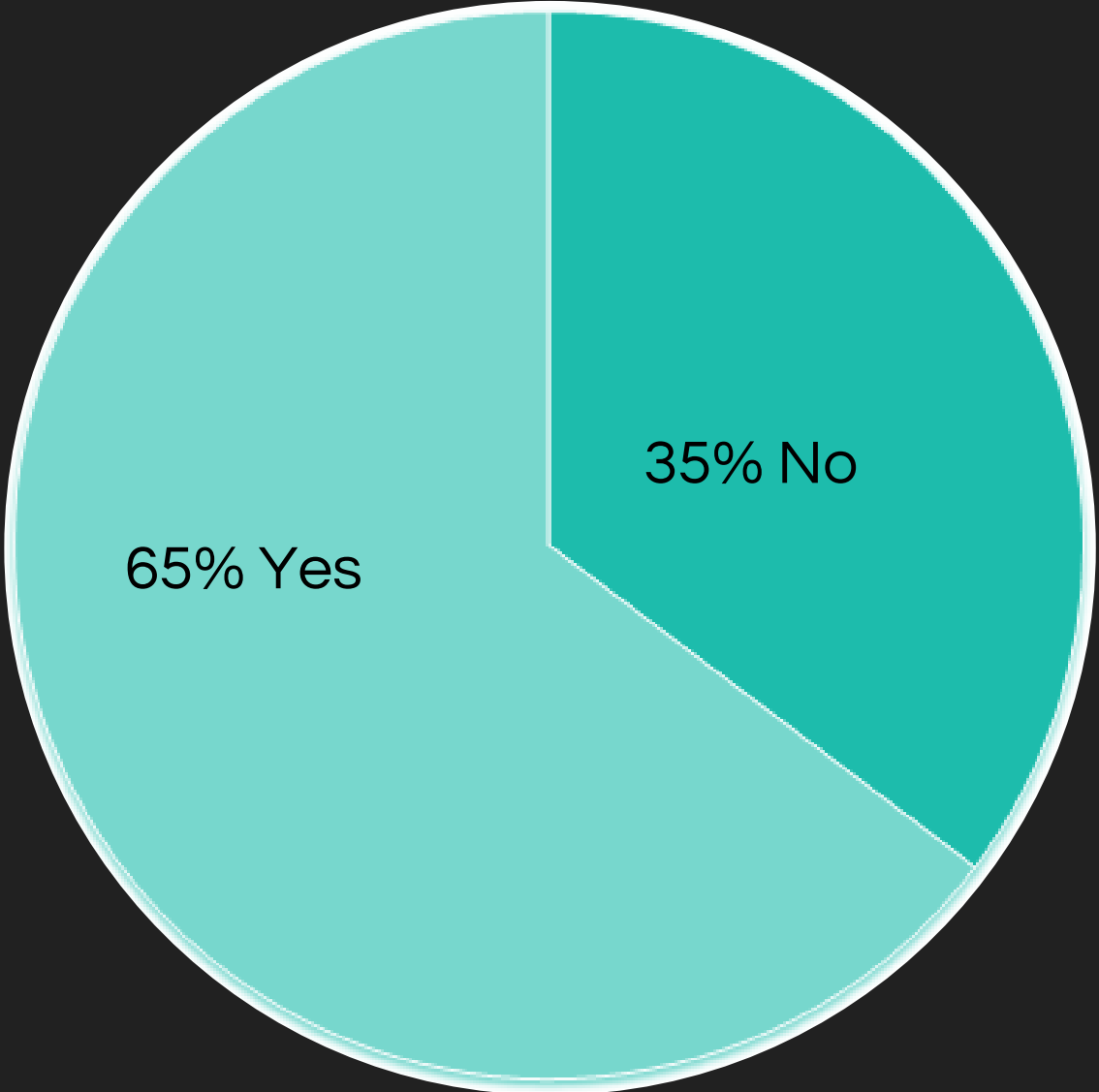
US:

- 91 Airlines with Air Operator Certificate issued by FAA in US
- 6,781 Total Aircraft in US

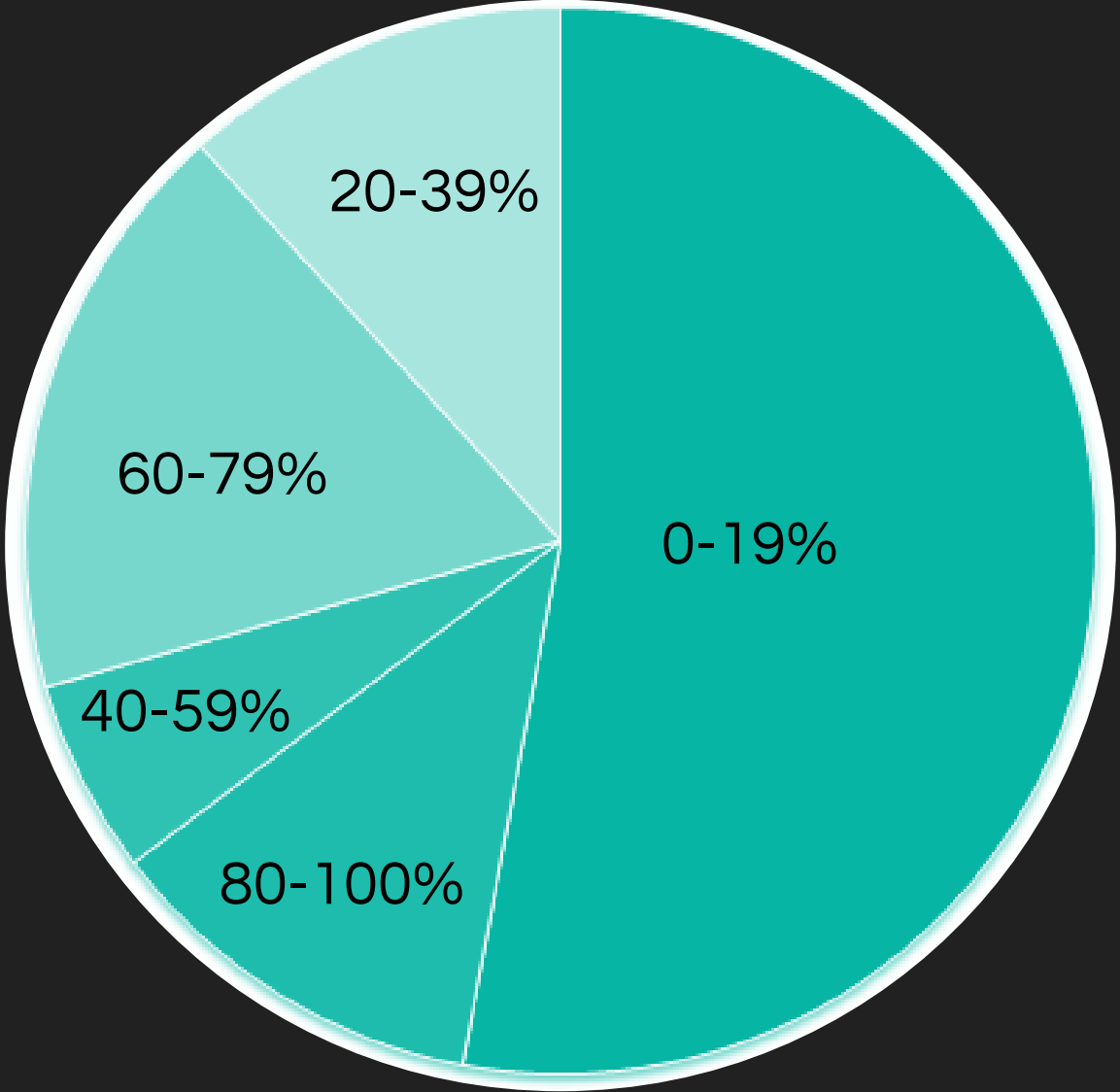
WORLD:

- 17,770 Total commercial airplanes

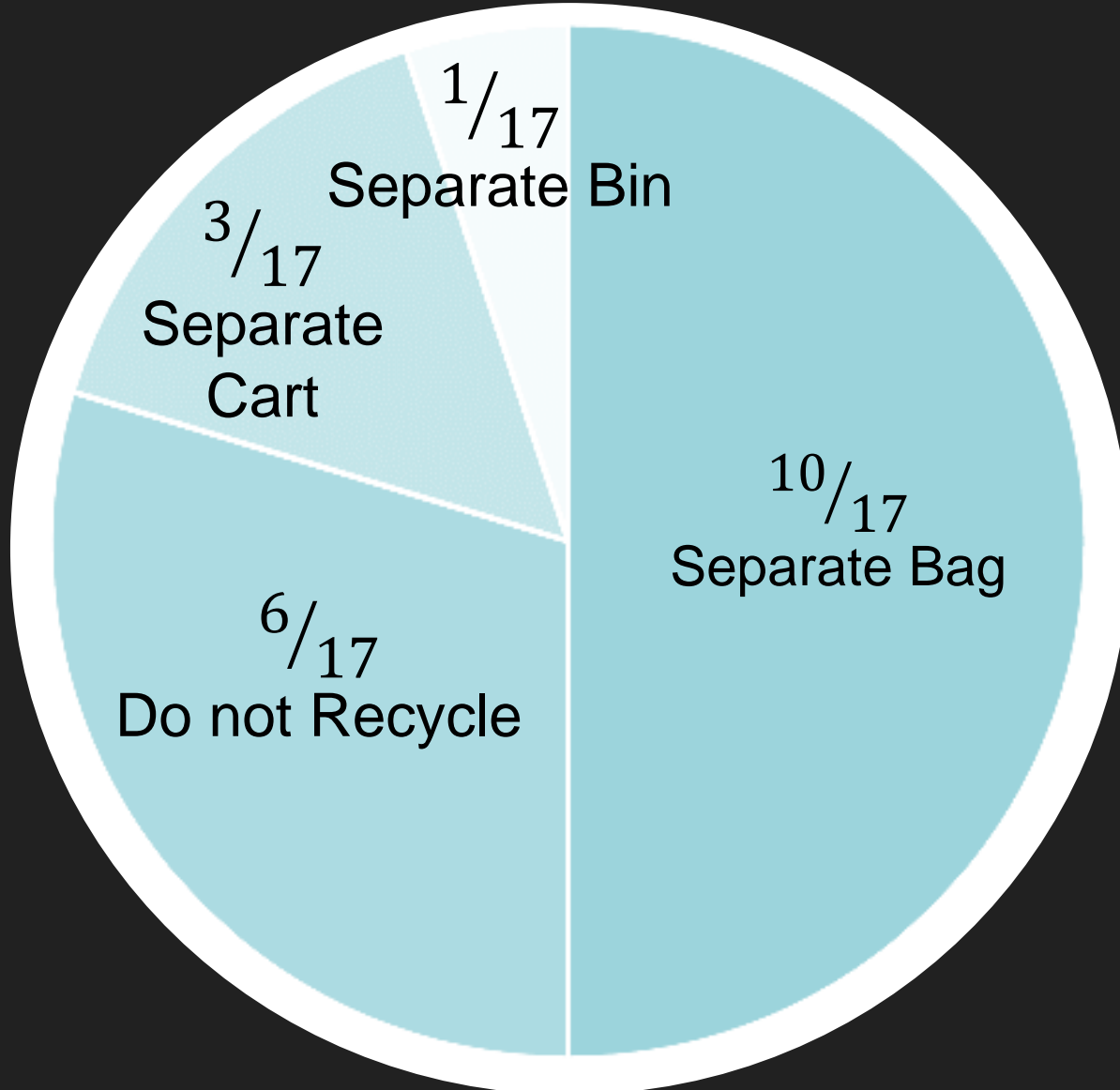
Does your airline recycle in-flight?



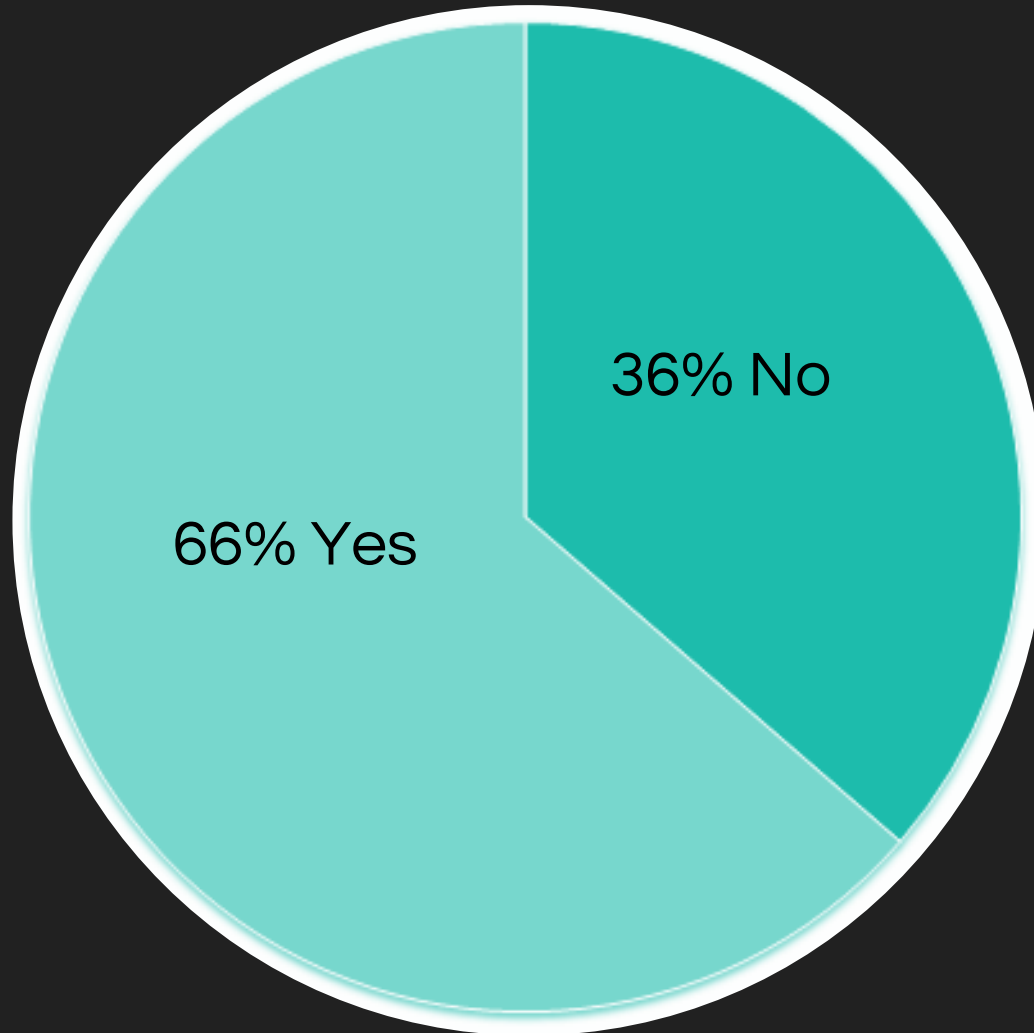
Percentage of Recyclables Recycled



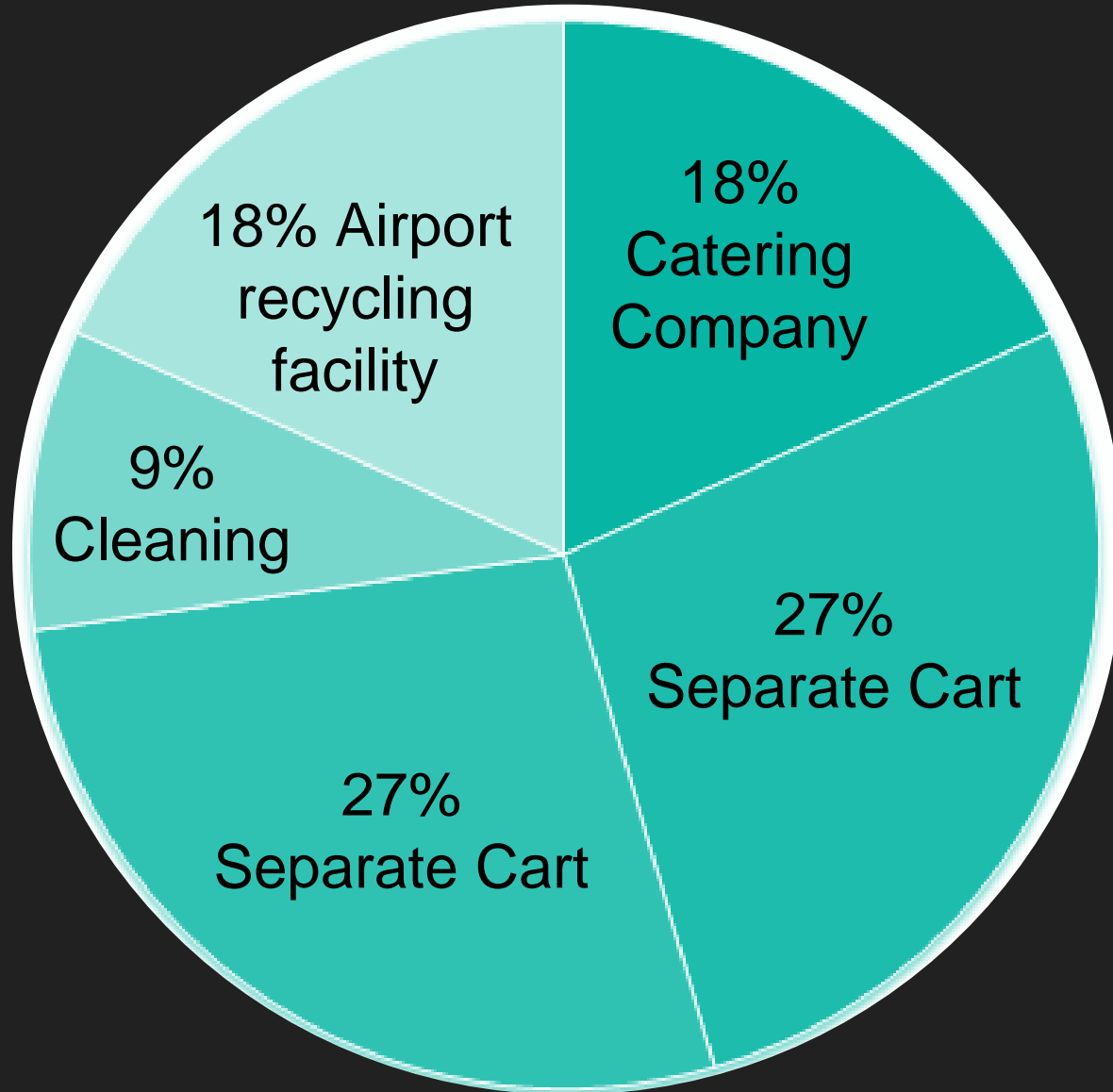
How are recyclables collected?



Is there adequate room for waste storage?



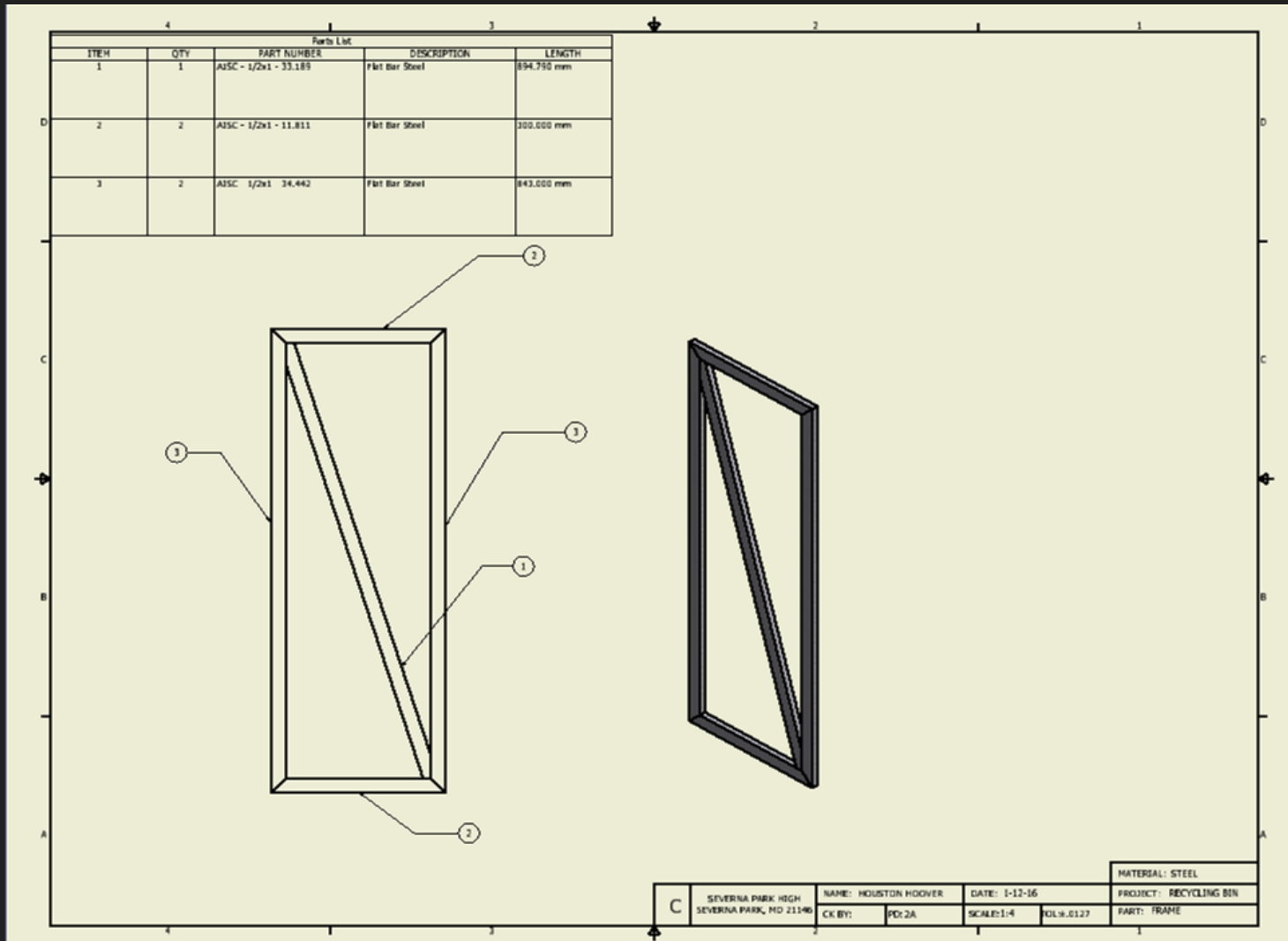
How is waste removed?



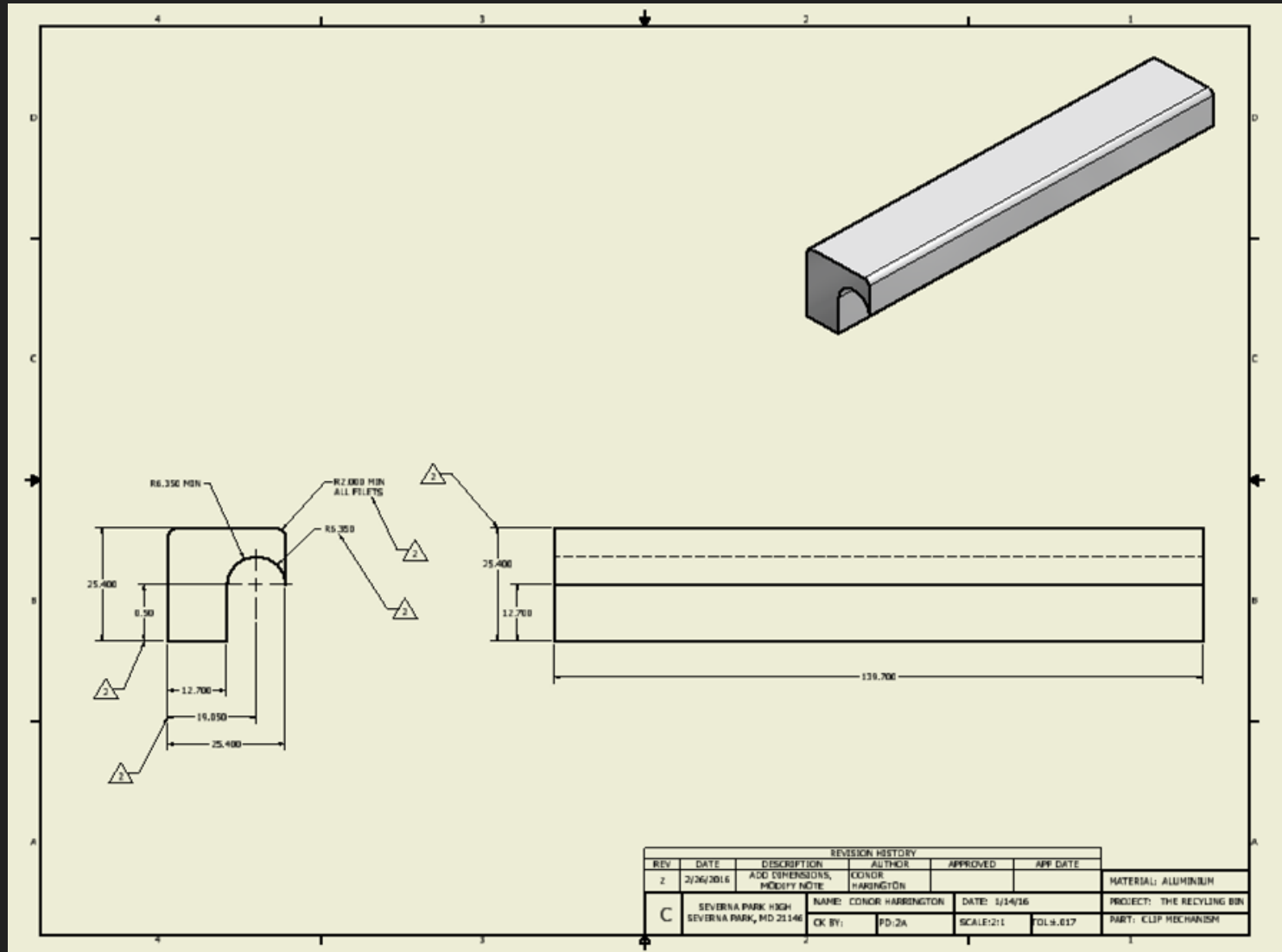
Materials

- Zinc-Plated Steel Recessed Folding Pull Handle
- 3003 H-14 Aluminum
- 304 Stainless Steel
- Heavy Duty Nylon Canvas
- Sex Bolts
- Felt

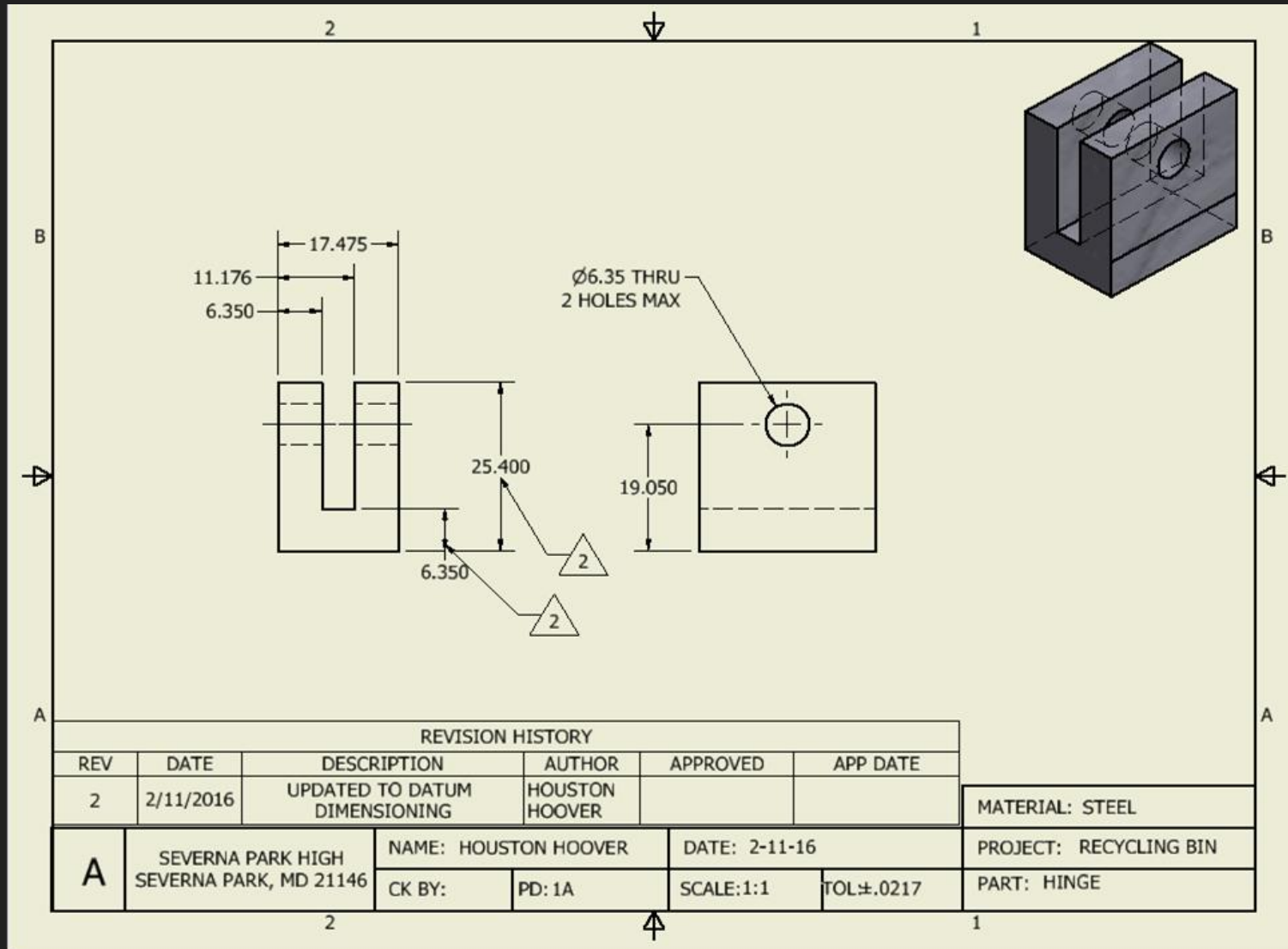
Orthographic Drawings



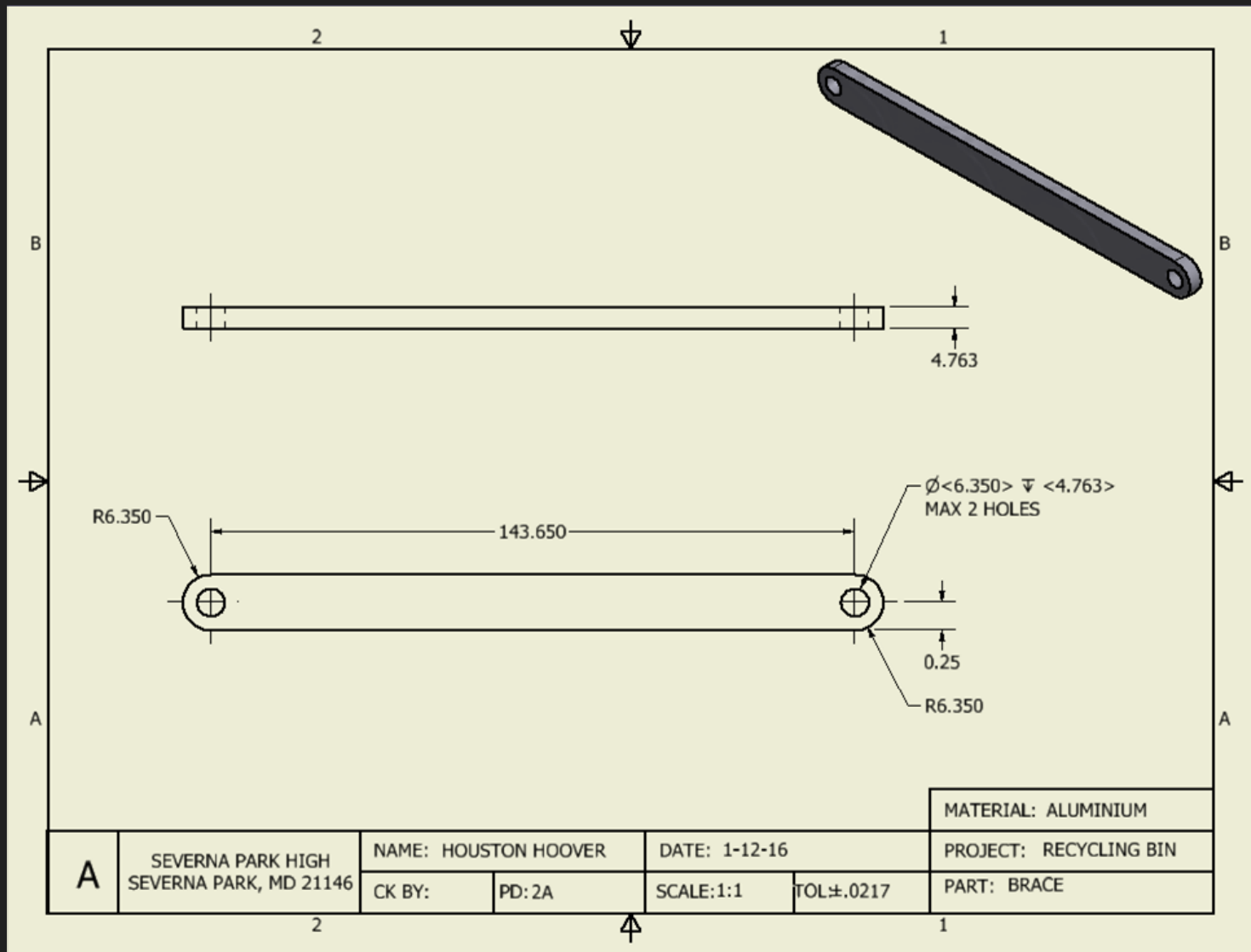
Orthographic Drawings



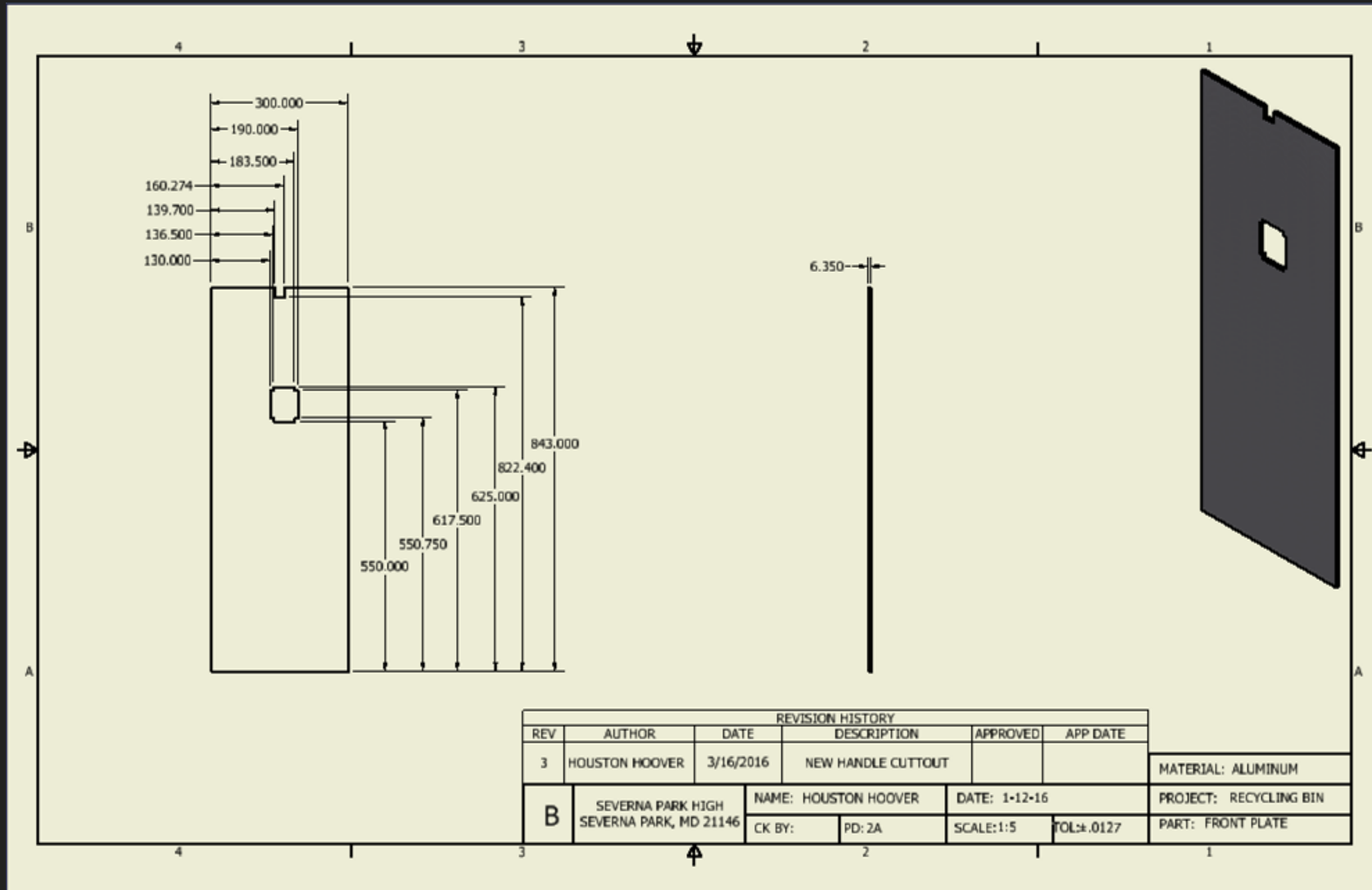
Orthographic Drawings



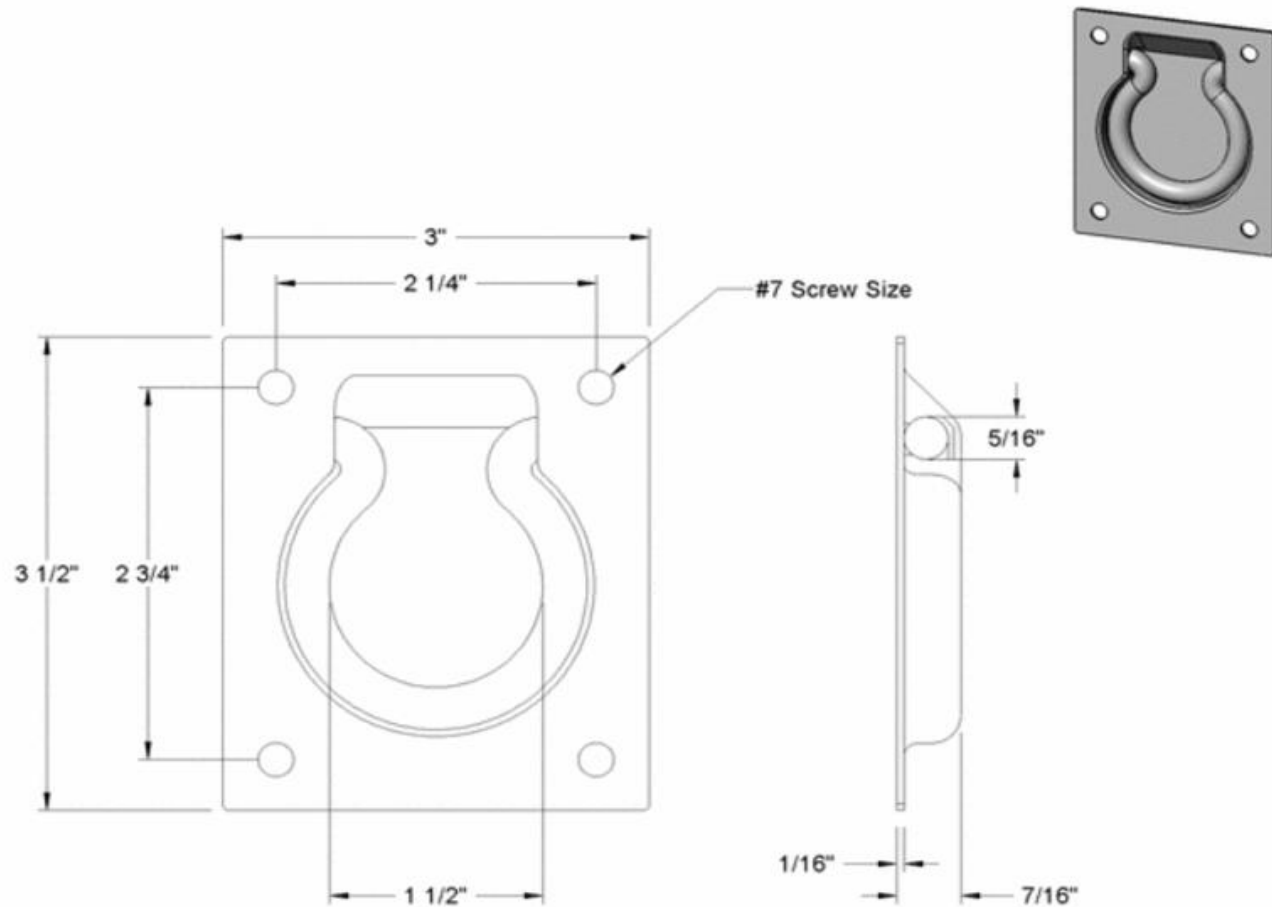
Orthographic Drawings



Orthographic Drawings



Orthographic Drawings



McMASTER-CARR CAD

<http://www.mcmaster.com>
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Information in this drawing is provided for reference only.

PART
NUMBER

1313A21

Zinc-Plated Steel
Recessed Folding Pull Handle

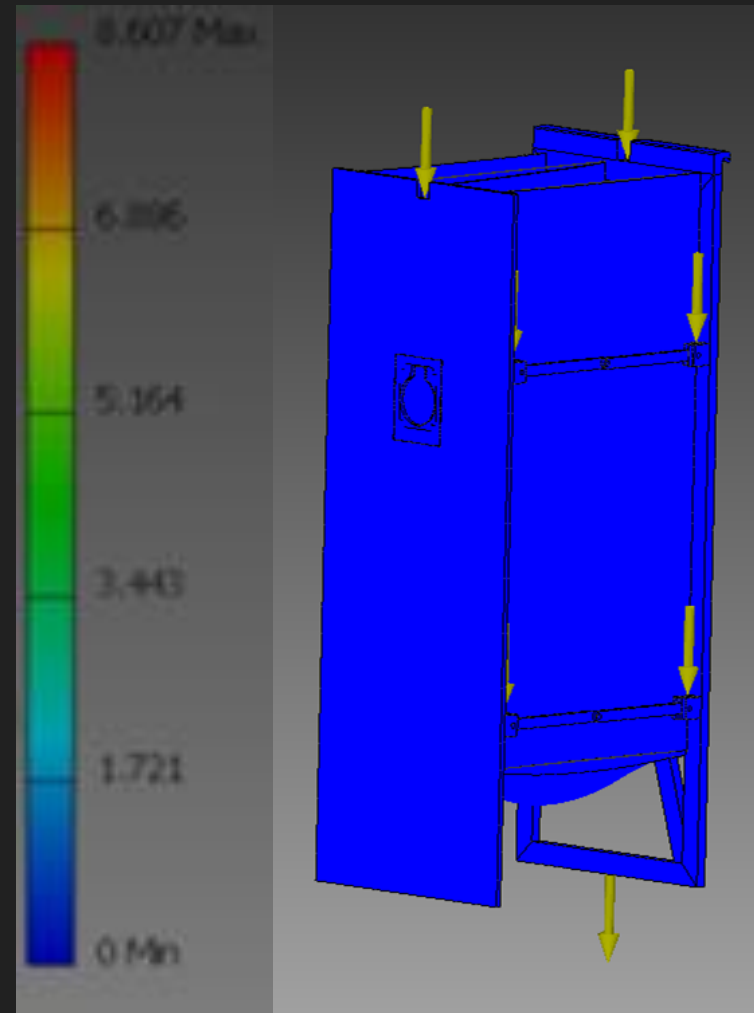
Sustained Weight

Trial	6.8 kg in trash bag	6.8 kg in recycling bag	6.8 kg in trash bag, 6.8 kg in recycling bag
1	Fail*	Pass	Pass
2	Pass	Pass	Pass
3	Pass	Pass	Pass

* Failure due to user ripping bag not device

Stress Test

Trial	Max Pressure (MPa) and Location
1	0.4 on top of Hinge
2	0.4 on top of Hinge
3	0.4 on top of Hinge



Cost Analysis

Felt: \$5.29

Handle: \$6.04

*1/8" 3003 H-14 Aluminum Total:
\$56.36*

- Inside Frame: \$28.18
- Outside Frame: \$28.18

*304 Stainless Steel Total:
\$51.12*

- Braces: \$22.72
- Hinges: \$28.40
- Nylon Fabric: \$16.50

Bolts Total: \$28.13

4x1 in": \$8.68

4x1.5 in": \$19.49

Cost to Machine: \$4.22

Labor Cost: \$24

Manufacturing Cost: \$220.00

(Marked up 15%)

Selling Price: \$440.00

(Marked up 100%)

RecyclAir Implementation

- No Product or System
 - RecyclAir Attachment & System
- Product, no System
 - RecyclAir System
- System, no Product
 - RecyclAir Attachment
- Product & System
 - RecyclAir System

Goal: Universality

Future Iterations

- Locking Mechanism on Scissor Lift
- Adjusted frame to allow dog ear latches to lock without removing attachment
- Gear system to make device easier to use
- Test different locking mechanisms
- Machine from intended materials
- Explore possibility of innovating waste trolleys