BOEING A.B.S.

BOEING ASSISTED BAG STOWAGE:
An assistive technology for loading carry-on and personal item baggage into overhead compartments. Designed for Boeing 737 MAX

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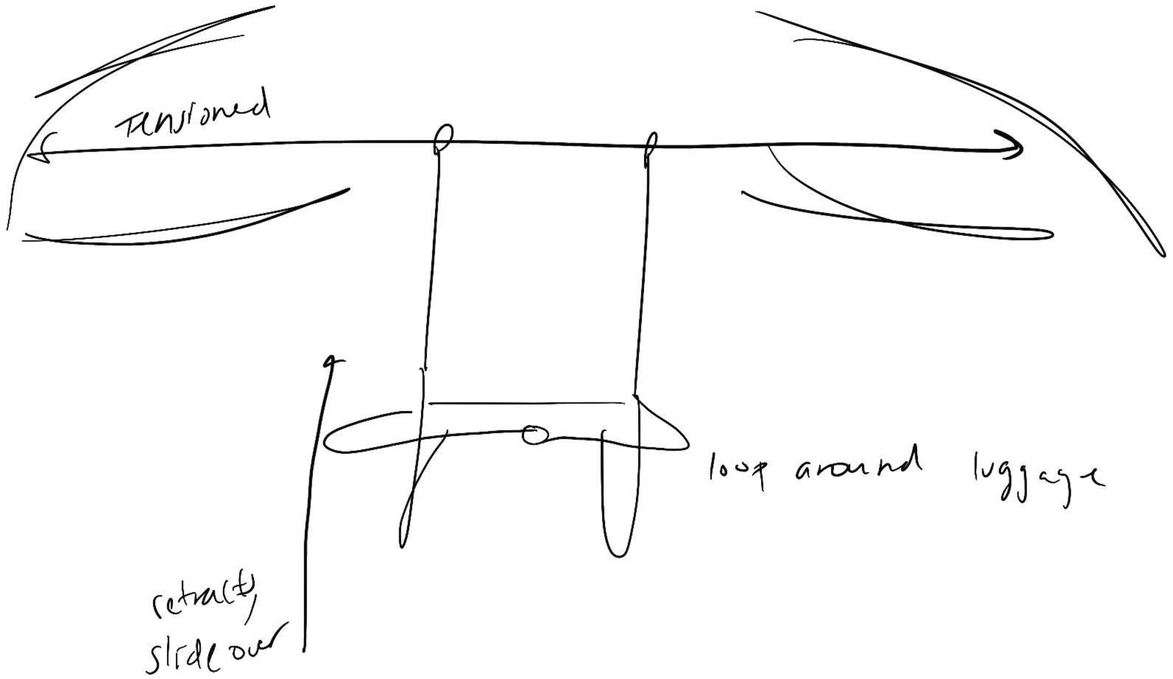
MISSION STATEMENT

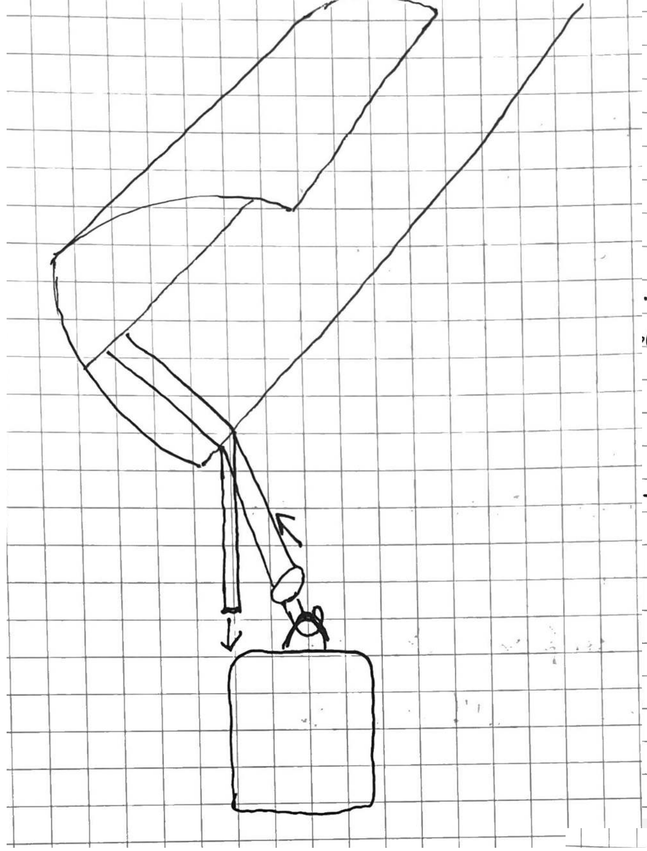
Boeing ABS was designed to improve the boarding process for all passengers on a Boeing aircraft. Not every passenger needs help stowing their bags, but by allowing the passengers most in need of assistance the ability to quickly do so, all passengers are able to board faster. As classic lifting methods are still accessible, the Boeing ABS system does not slow down any passengers, even those not using it.

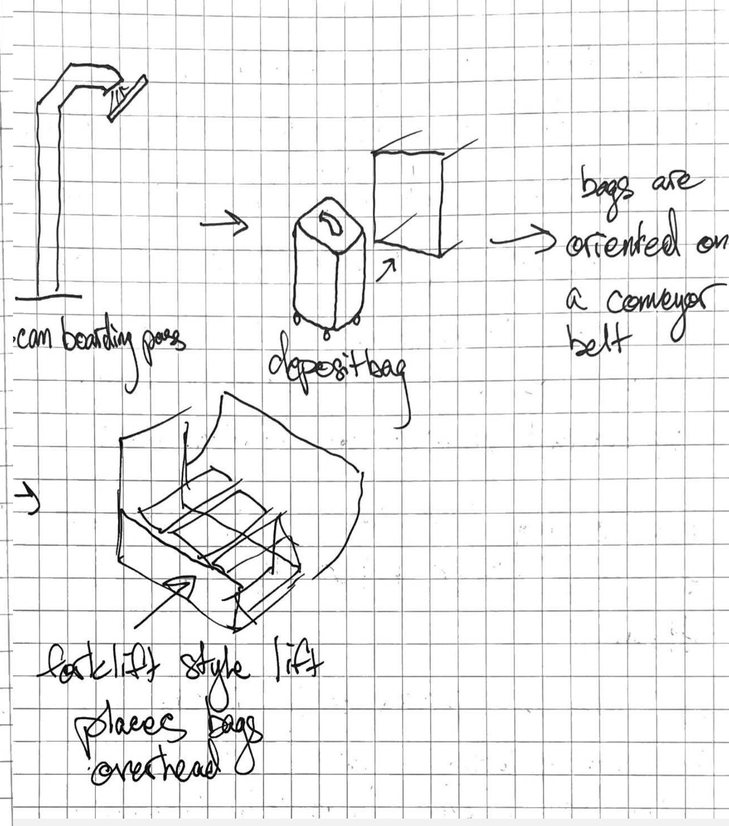
DESIGN CONSIDERATIONS

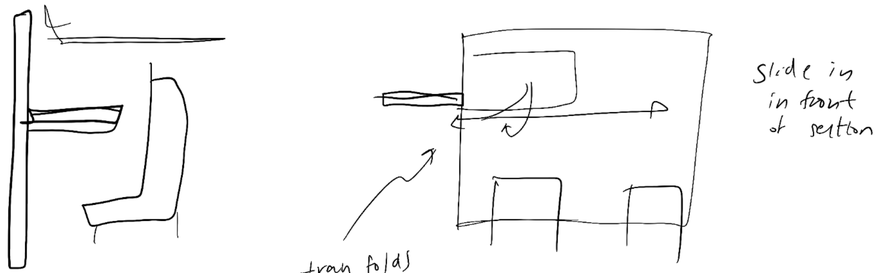
- Designed around Boeing’s newest aircraft and newest bins - the Boeing 737 Max-9 and Space Bins
- Capable of lifting, stowing, and lowering both carry-on and personal item sized baggage of up to 35 lbs
- Prioritize safety and ease of operation
- Must speed up boarding process
- Minimize cost and weight
- Implement into existing aircraft

01
BRAINSTORMING

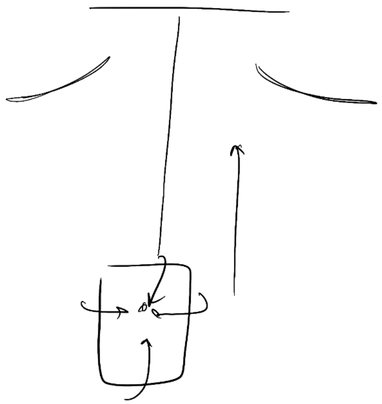


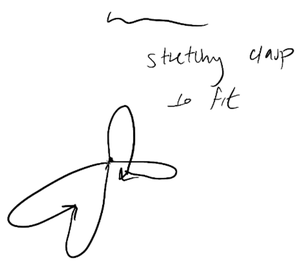


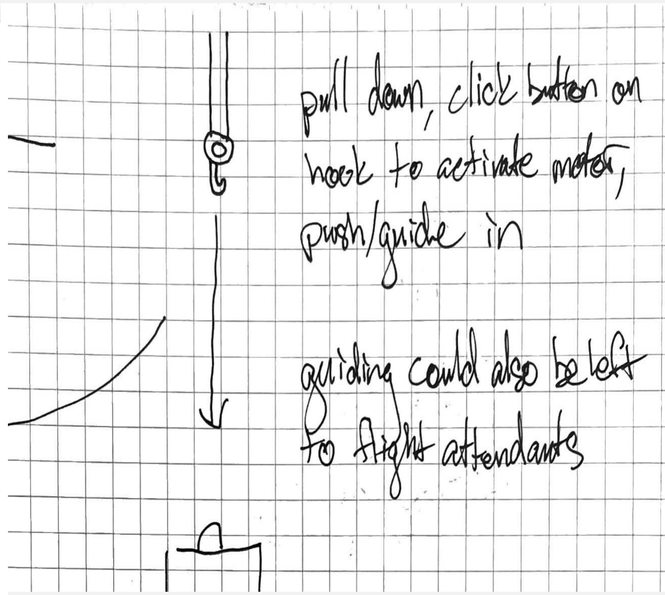




Slide in in front of seatback



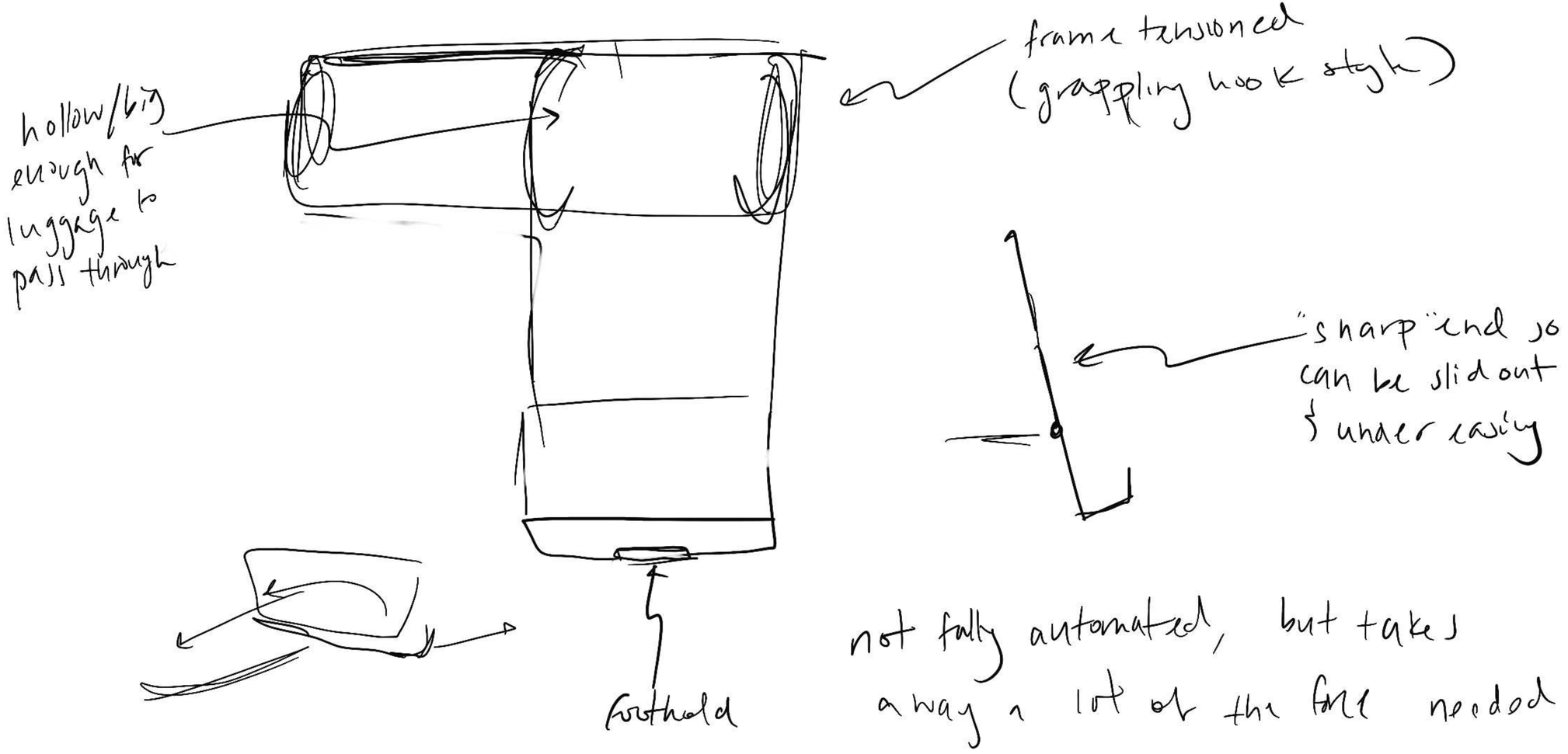


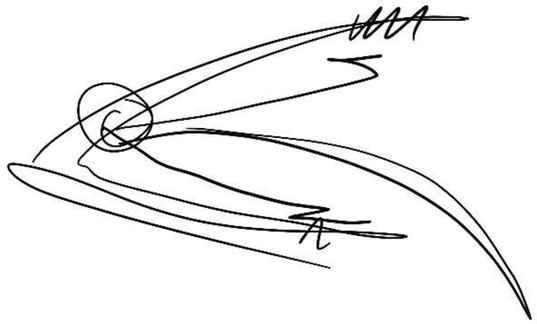


Pull down, slowly rises, push bag over
remove before takeoff?

FINAL CONCEPT DECISION

- A majority of passengers are capable of lifting their bags into overhead bins
- Designing to vastly decrease the amount of time for the slowest passengers to stow their bags, without slowing any passengers
- Minimizing weight of system and ease of implementation into existing aircraft
- Require a system that can adequately lift and lower bags

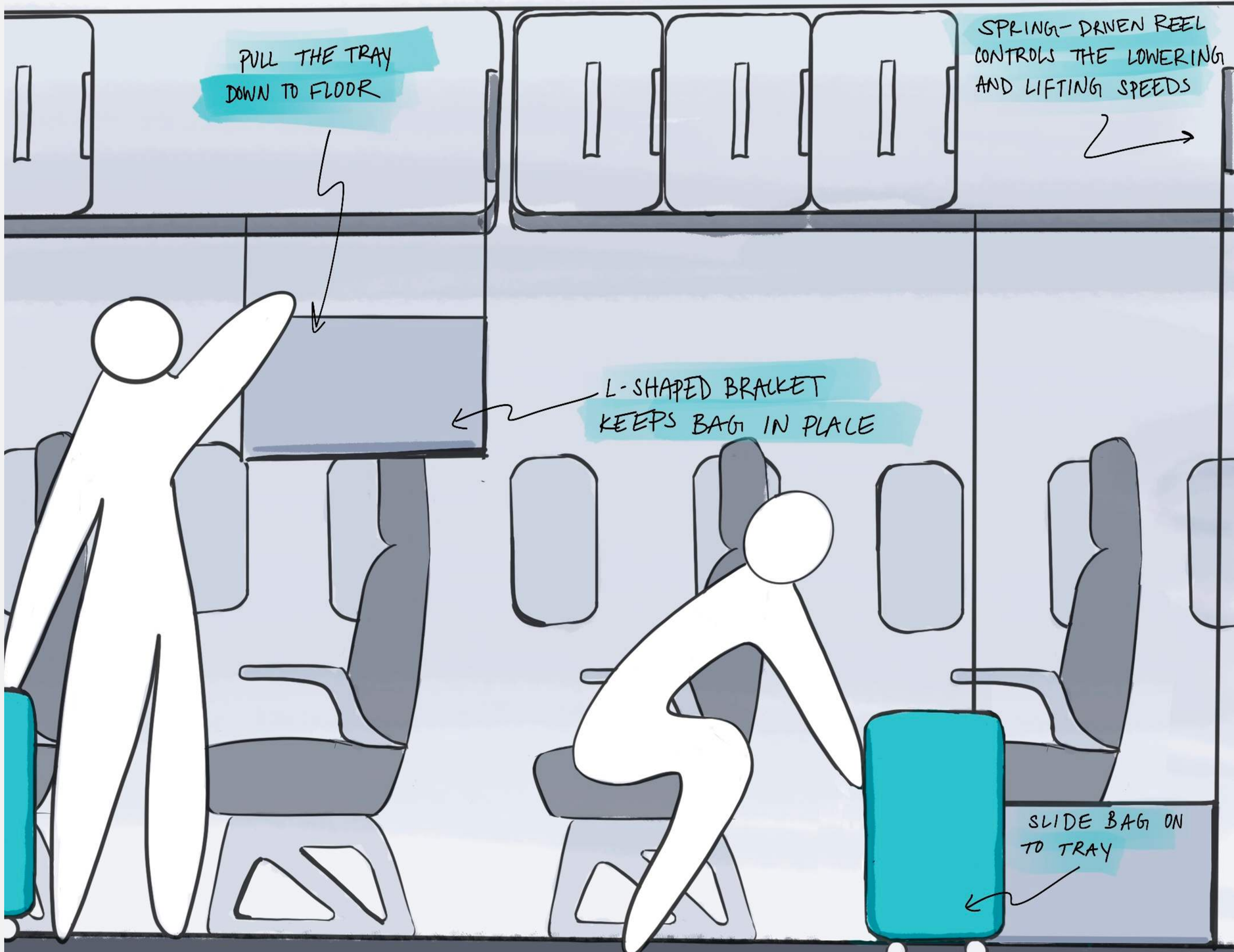




Brainstorming started with individual concept generation to foster a variety of potential solutions

INSTRUCTIONS:

1. Open the overhead bin and pull down the lift tray (tray will lock in lowered position)
2. Place bag on lift tray
3. Pull lightly on the lift cables to activate spring-assisted retraction
4. Lift the bag and tray
5. The tray will tilt over the edge of the bin; lightly push your bag into the bin
6. The tray is now locked at the top of the bin. Slide your bag down the bin and the lift system is ready to help the next passenger



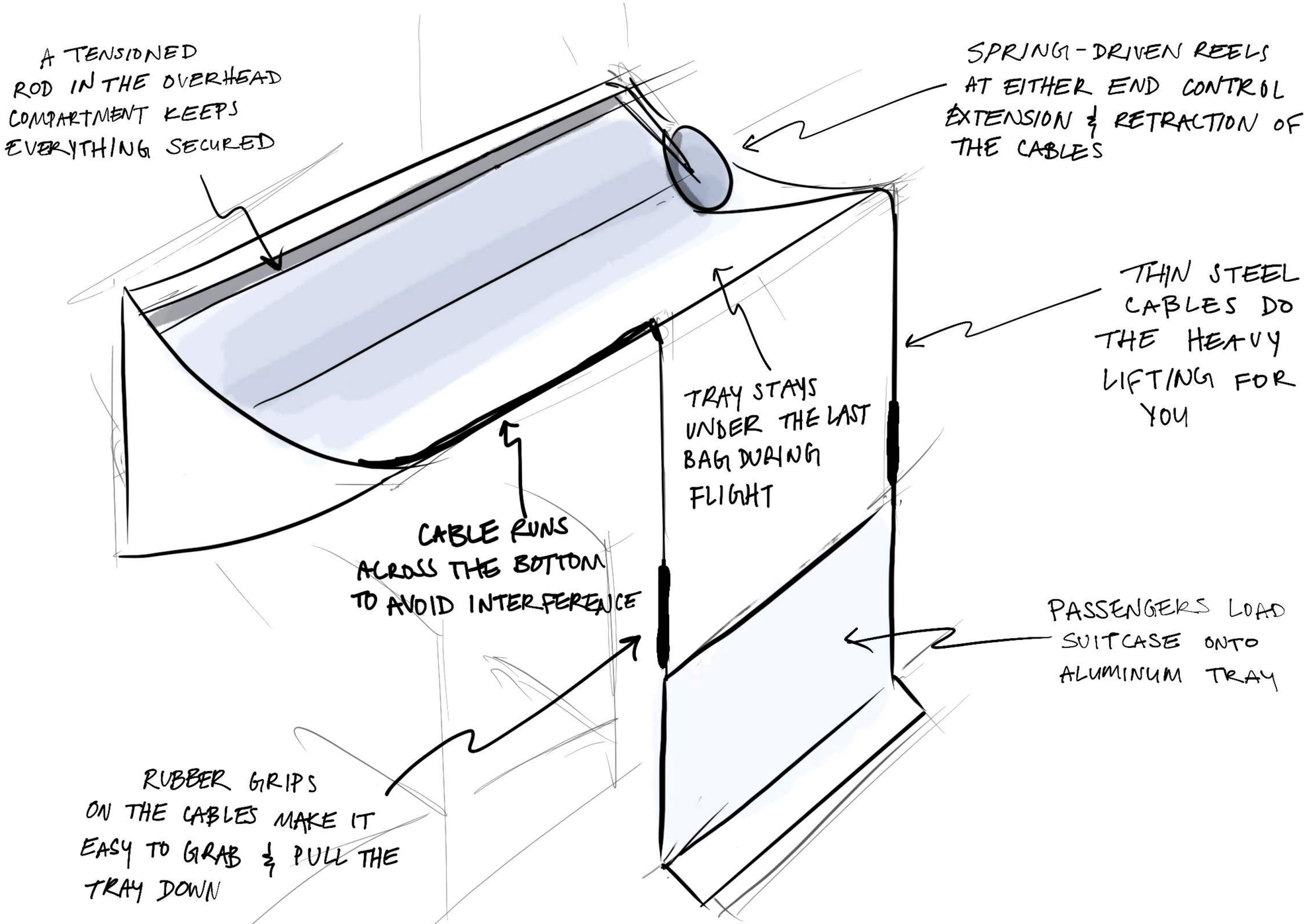
Rationale of Design Choices

- Spring-driven reel with maximum supported load ~20 lbs: We wanted to ensure that there would be no accidental lifting of baggage. With a minimum baggage weight of 15 lbs, and 4 lbs for the weight of the tray, this maximum load means the tray will only rise with human assistance

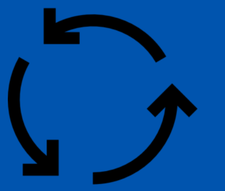
- Aluminum tray: A light yet sturdy material for weight reduction

- Cutouts in the tray and reel: Reduces the weight of the tray and allows the wheels of the bag to fall through to prevent potential tipping

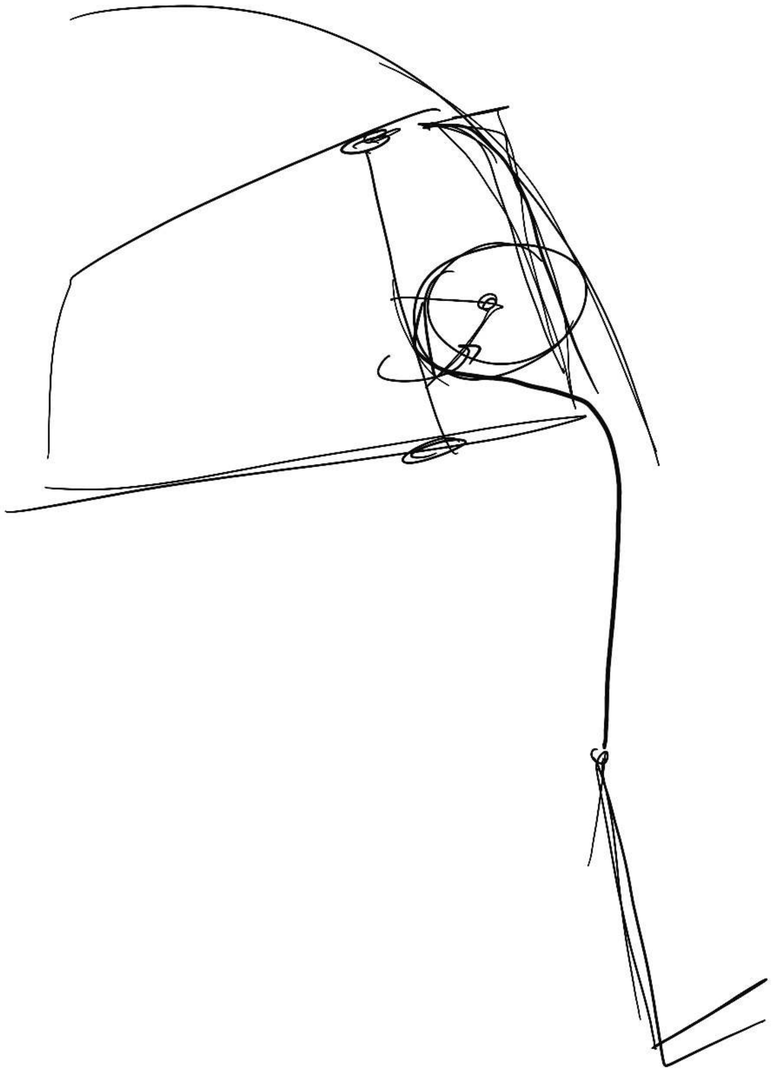
- Implementation within overhead bins: To maintain aisle space and avoid interfering with active boarding

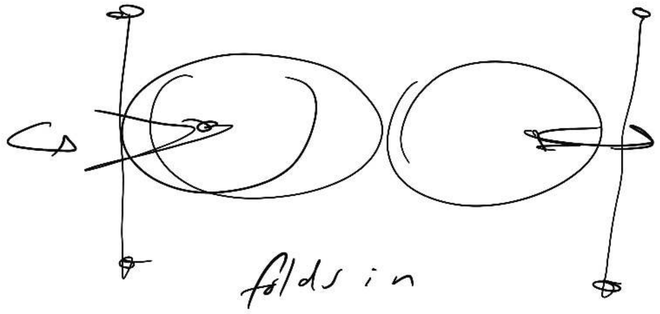

A TENSIONED ROD IN THE OVERHEAD COMPARTMENT KEEPS EVERYTHING SECURED
SPRING-DRIVEN REELS AT EITHER END CONTROL EXTENSION & RETRACTION OF THE CABLES
THIN STEEL CABLES DO THE HEAVY LIFTING FOR YOU
TRAY STAYS UNDER THE LAST BAG DURING FLIGHT
CABLE RUNS ACROSS THE BOTTOM TO AVOID INTERFERENCE
PASSENGERS LOAD SUITCASE ONTO ALUMINUM TRAY
RUBBER GRIPS ON THE CABLES MAKE IT EASY TO GRAB & PULL THE TRAY DOWN

ITERATIVE PROCESS

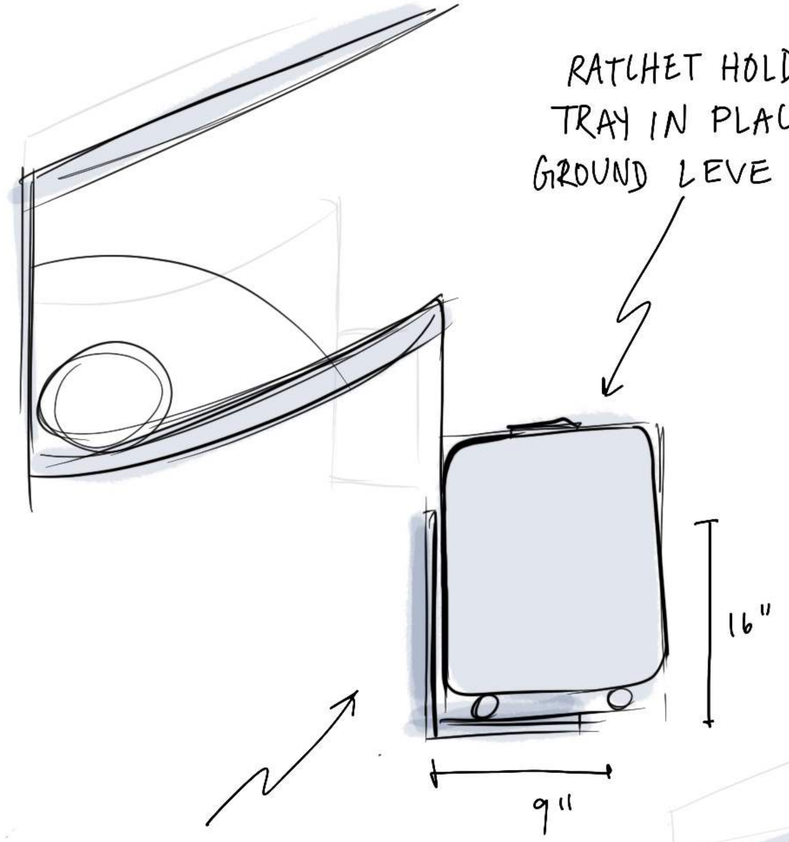


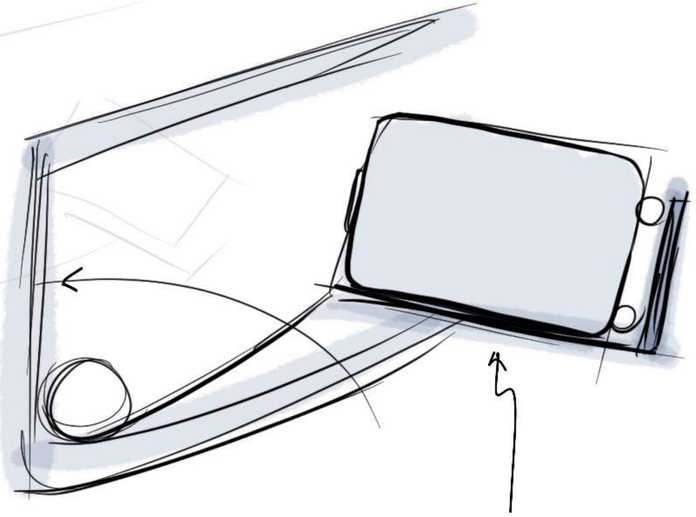
- Initial designs used a tension rod to keep ABS in place. This was discarded in favor of directly installing the reels to the sides of the overhead compartments
- Rubber grips were added to prevent possible discomfort when activating the spring-assisted lift
- Cutouts were added to the tray and reel for weight reduction. Cutouts in the tray also serve to prevent the wheels of the suitcase from causing it to tip and potentially fall while being lifted
- Width of the tray was reduced for weight management
- ABS system was placed at the front of each overhead bin so bags would not need to be pushed against the flow of boarding

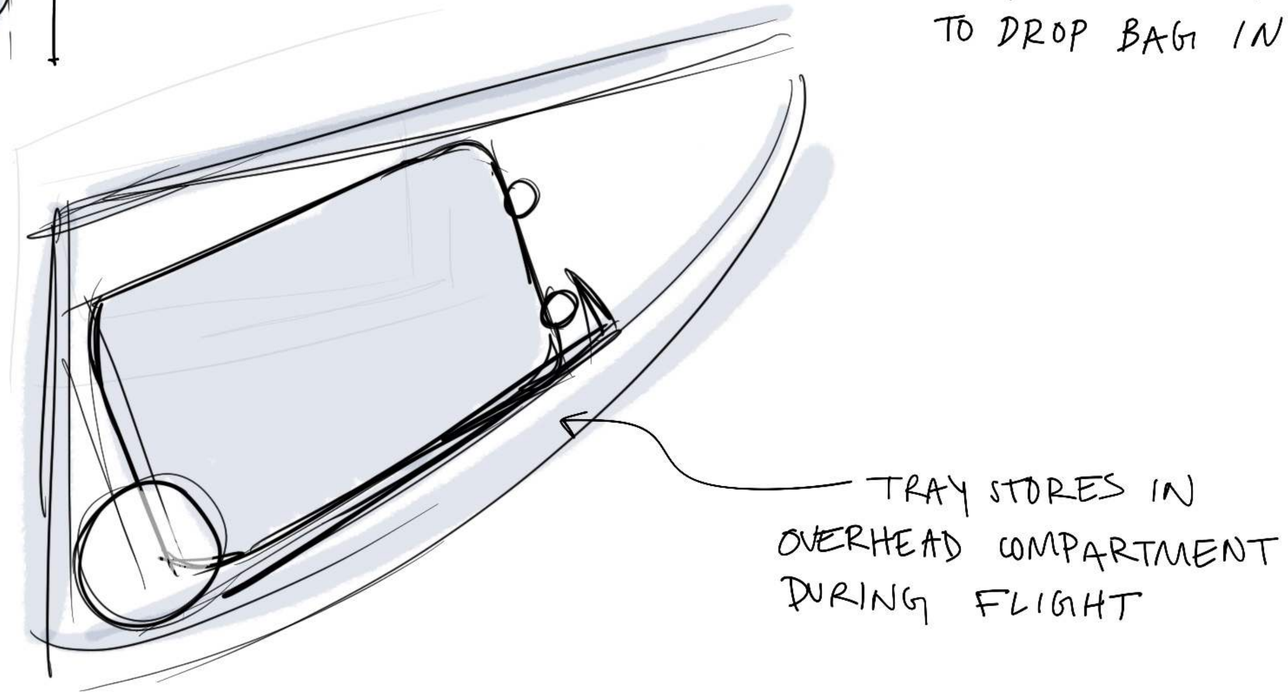




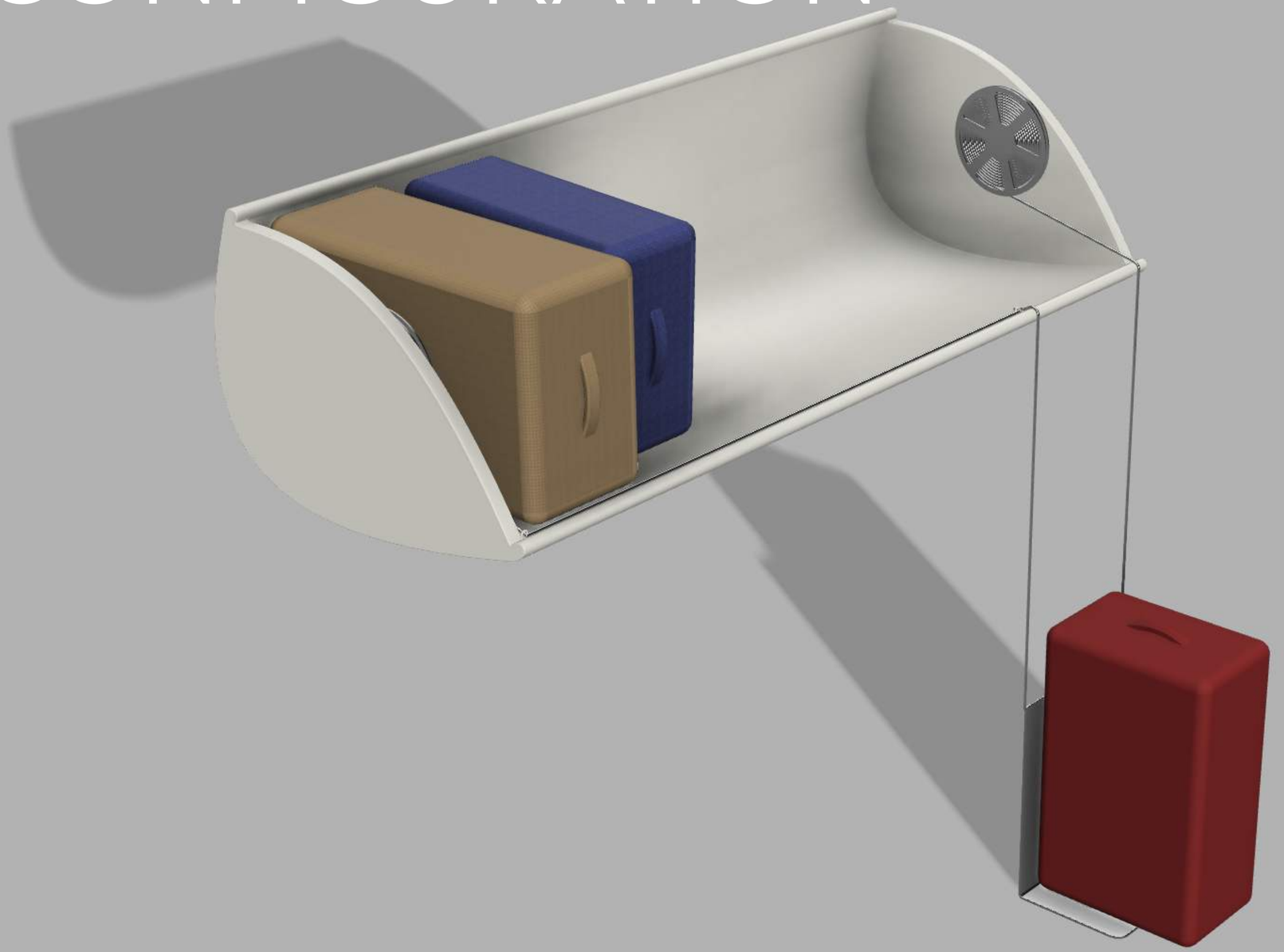
Much of the iterative process also centered on the stowage of the product during flight. A folding mechanism was considered before eventually deciding to have the tray remain under the last suitcase for the duration of the flight.


RATCHET HOLDS TRAY IN PLACE AT GROUND LEVEL
16"
9"
SPEED IS CONTROLLED BY SPRING-DRIVEN REEL

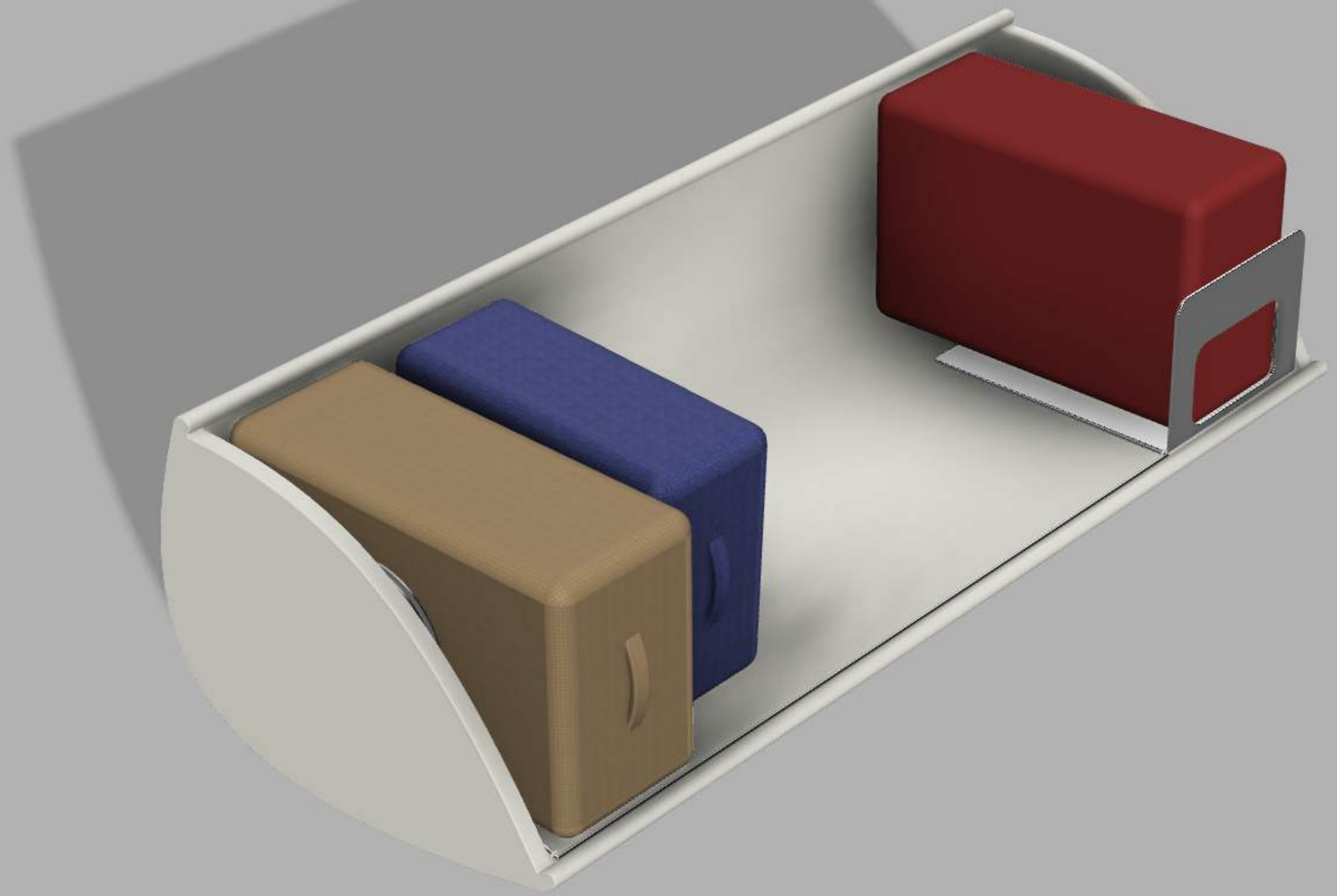

AT HALFWAY, TRAY CAN BE TIPPED TO DROP BAG IN


TRAY STORES IN OVERHEAD COMPARTMENT DURING FLIGHT

OPEN CONFIGURATION



CLOSED CONFIGURATION

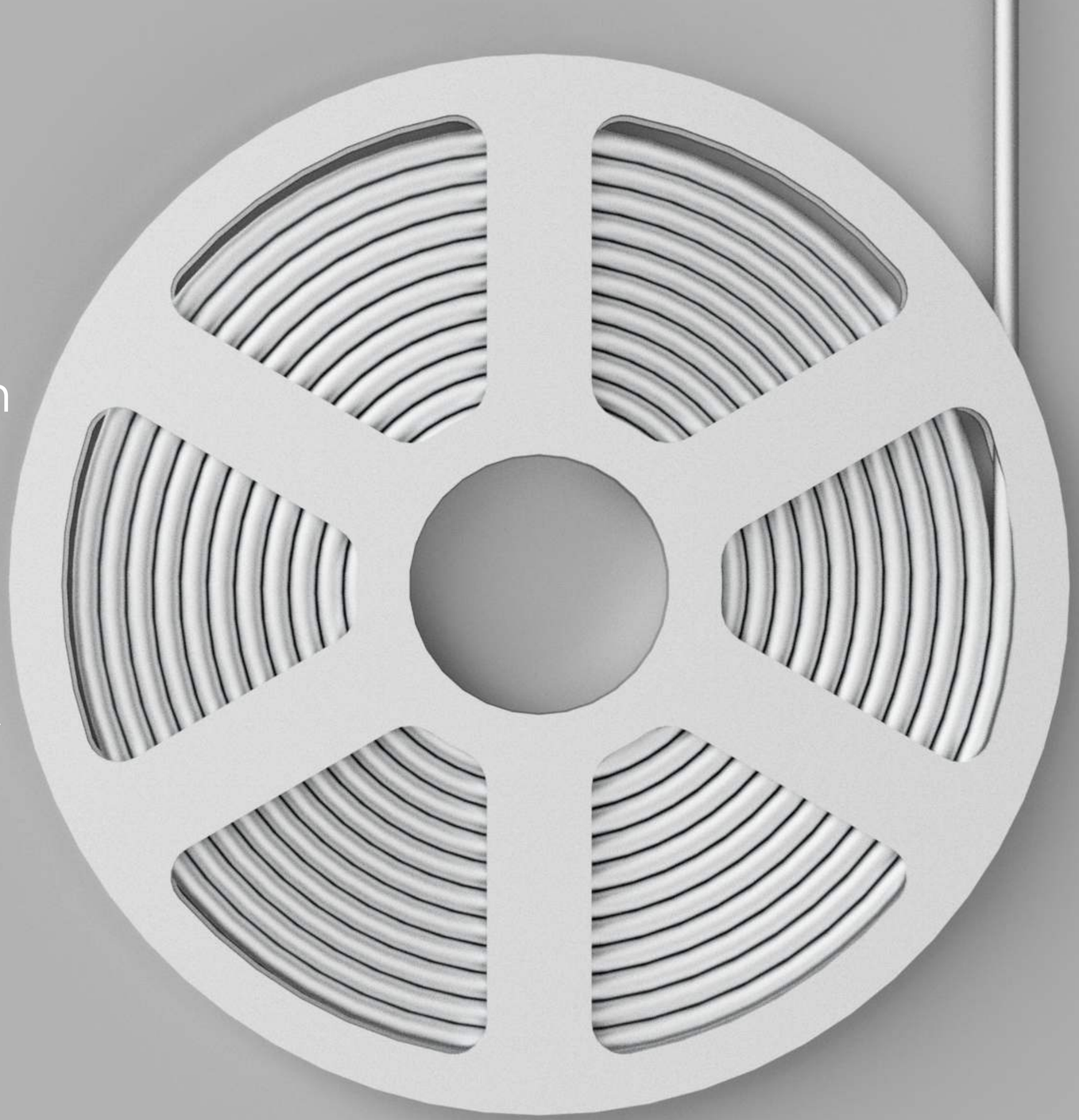


02
DETAILS

Spring-Driven Reel

When a load is applied, tension builds in the spring. When released, it will cause the reel to re-wind itself

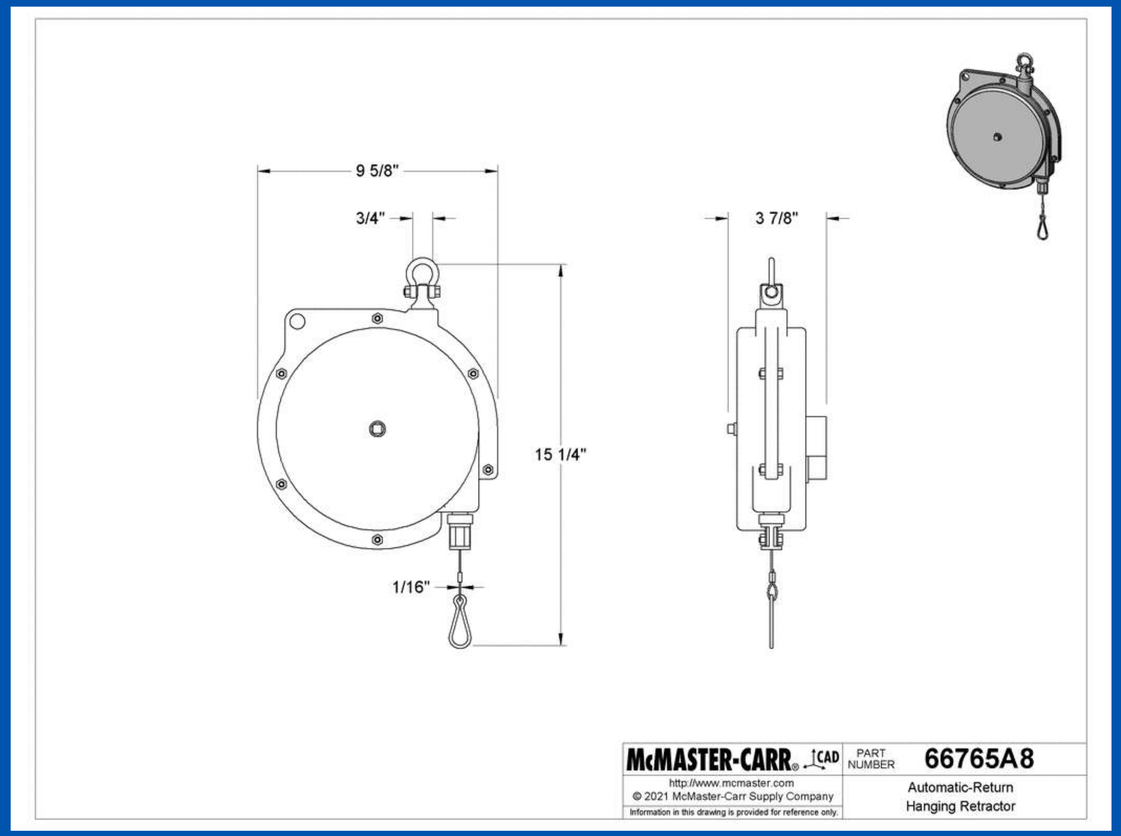
A cable lock keeps the cable at set positions to avoid accidental movement of bags. Tugging on the cable will release the lock.



McMaster-Carr 66765A8

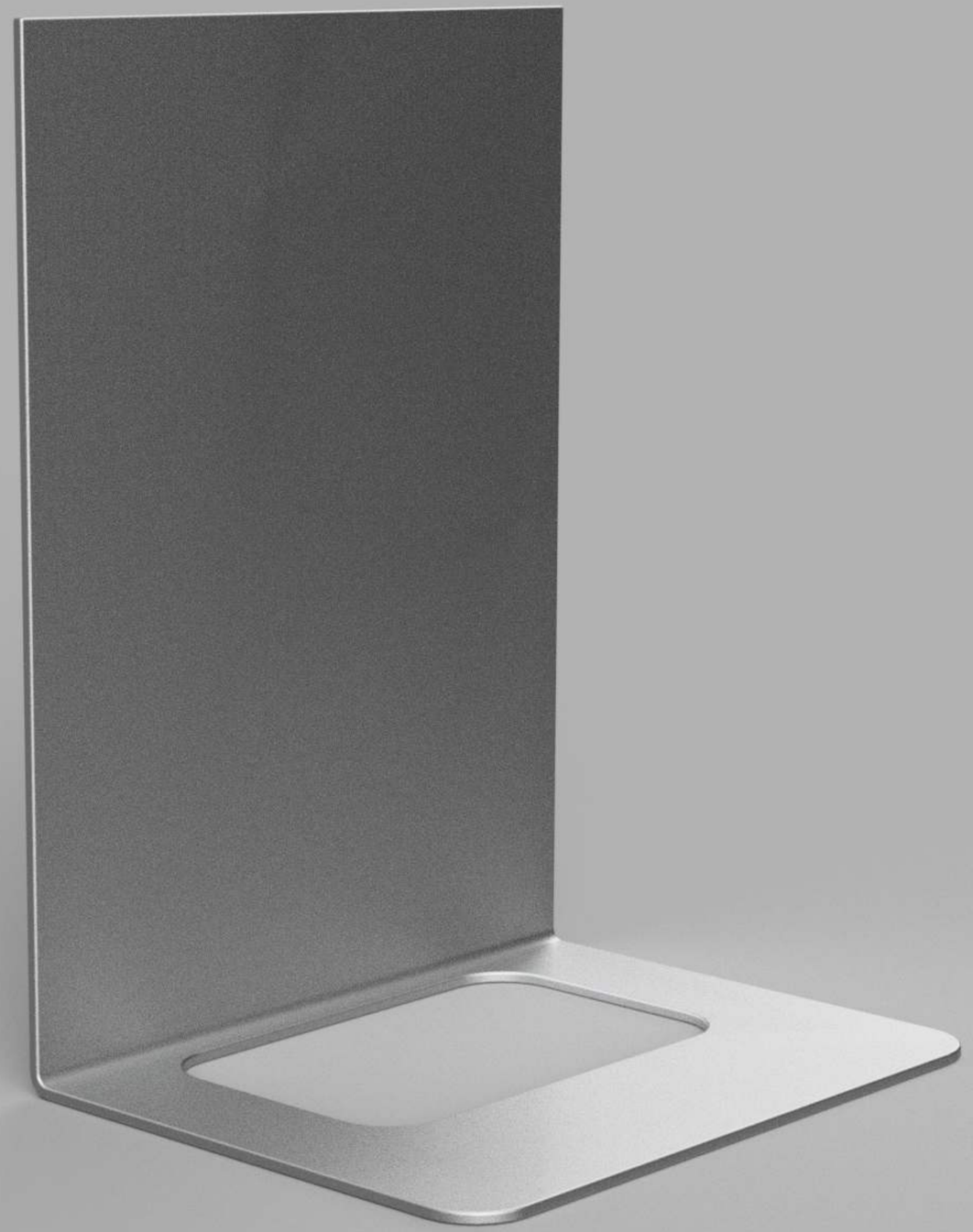
- An Automatic-Return Hanging Retractor
- 16-22 lb. capacity
- 8ft. of 1/16” steel cable
- Adjustable cable stop
- Aluminum housing
- Weighs 13 lb.

This is the most similar off-the-shelf component to what is used in the Boeing ABS design.



Lifting Tray

- Lightweight 6061 aluminum
- Fits both carry-on and personal item sized bags
- Safety prioritized: bags will not tilt off or fall on passengers
- Bottom cutout
  - Weight reduction
  - Allows space for wheeled baggage to sit lower, preventing dangerous tilting during lift
  - Offers easy access to baggage for manual settling and maneuvering once in compartment



03 IMPLEMENTATION AND ANALYSIS

LIGHTWEIGHT AND COMPACT

- Each McMaster-Carr component weighs 13 lbs, and the aluminum tray weighs 4.1 lbs for a total of 26 lbs per storage compartment. For the 33 storage compartments of a 737 MAX-9, **implementation of Boeing ABS adds 993.3 lbs, equivalent to 5 male passengers**
- A spring-driven reel **does not require a power source**, saving room and energy compared to other mechanized solutions
- ABS is able to be **stored directly within the overhead compartments**, so it doesn’t take up any extra space

PRESERVES AISLE SPACE

- **Does not block aisle** more than manual baggage lifting while in use
- Completely out of aisle while not in use or in-flight
- Increases speed of slowest passengers, **clearing aisle faster**
- Installation in each overhead compartment means **there’s no need to move the system through the aircraft**, which would slow boarding

PRIORITIZES PASSENGERS

- The design **allows for use by multiple passengers**: each passenger simply lifts their bag and slides it down the compartment, and then the lift is ready for use by the next person
- Should passengers elect not to use the system, **manual storage of a bag is as accessible as before** and will not slow the boarding and bag loading process

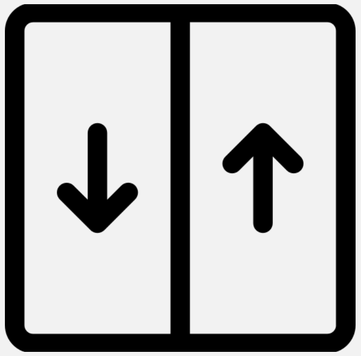
SIMPLE IN-FLIGHT STORAGE

- As bags fill the compartment, **the final bag lifted by the ABS system will not need to slide down**
- **The tray is stored underneath the final bag** for the duration of the flight, negating any need for flight attendants to retrieve systems before takeoff
- Upon landing, the **system is already prepared for bag retrieval**

04
TRADEOFFS

INSTALLATION

ABS requires a one-time installation, which can be performed during or post-production



ASSISTED LIFT

Does not offer a completely motorized lift of baggage, only an assisted lift

EDUCATION

New technology requires education of passengers for successful use despite intuitive design

05 POTENTIAL IMPROVEMENTS

MANUFACTURING

- Calculated weight of 993.3 lbs per 737 Max 9 (~30 lbs per system, one per overhead compartment) is based off available off-the-shelf parts
- Weight can be heavily reduced with custom designed spring assisted pulley systems and use of aerospace-grade materials

IMPLEMENTATION

- Successful trials of the Boeing Assisted Bag Stowage system could lead to a redesign to implement the system into production aircraft
- A slight redesign of overhead compartment systems could better integrate an assisted baggage lift into aircraft, increasing safety and ease of use while decreasing cost and weight

THANK YOU

Presentation image credit: Boeing