

**"To remove the bag from the journey is to change the journey"**

*The New York Times*



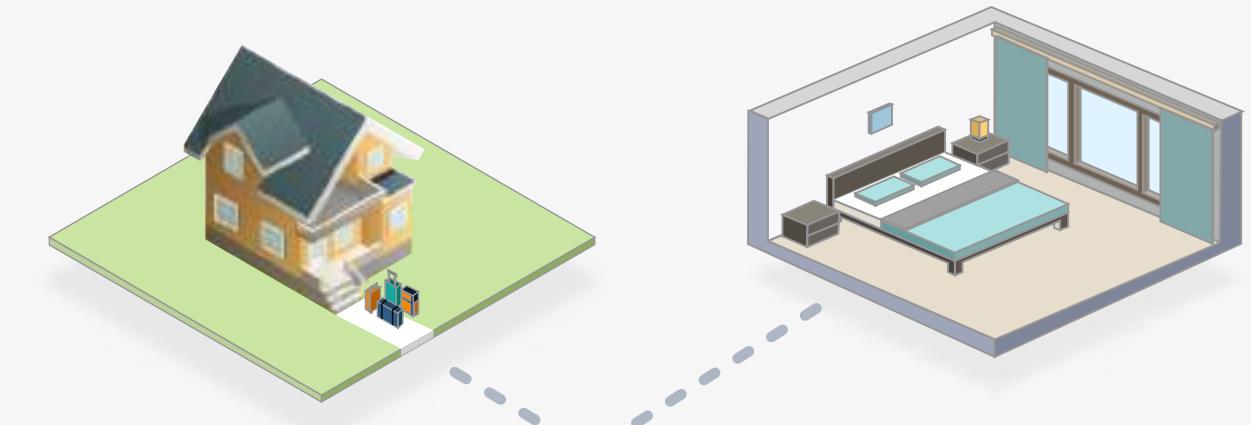
Vidar Nordli-Mathisen

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# Project overview



This project explores the near future of luggage and how its design might evolve to become something that travels separately from its owner. With the right service and product design this concept would give freedom to the traveller, streamlining their travel experience, reducing stress and minimising costly infrastructure.

## Product Idea

This project is a Door-to-door service collecting your belongings at home and delivering it right to your destination. In order for this service to be logically and economically feasible, the design of luggage needs to be reconsidered for this new environment and service.

‘Case’ is a product that is provided with the service and rented by users as part of the journey. Replacing the need to own luggage anymore.

# Project brief

How might we reimagine the transportation of our belongings in a world where luggage travels separately from its owner?

There is an opportunity to re-design the suitcase to enable this transition towards the future of mobility. Users expect a product which guarantees the security of its valuables, is stylish to use, adjustable in volume and can monitor its progress throughout travel.

Logistics operators require a product optimised for its environment. High in strength, RFID enabled and optimised for travel.



## User

Young professionals living in urban cities. Part of a growing demographic who don't own a car, who value freedom and ease of movement.



## Environment

The product will need to be appropriate for use in living spaces, whilst also be designed for the most efficient use of logistics infrastructure.

## Market

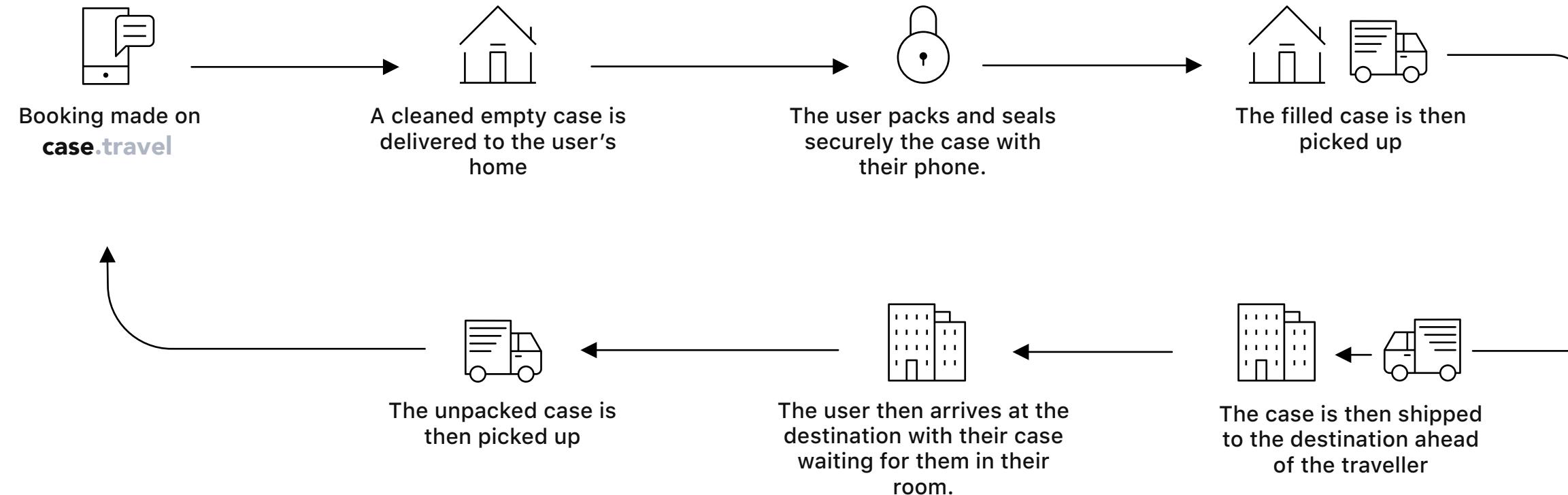
Such a product would greatly enhance the experience of travel, allowing individuals to feel relaxed throughout their journey. It reduces the need for expensive human-to-baggage infrastructure and will amplify the use of shared mobility services.

Several market competitors exist proving that the concept, in theory is feasible and improves the experience of the traveller. The challenge many of these pilot programs face are with the variations of luggage form and its seamless transition across baggage handling services.

## Proposal

Unencumbered by luggage, this caters for a new type of passenger experience. Although a big proportion of this idea is a service, it is in fact the product that will be the enabler of this. It is important that the product enhances the experience of a traveller, whilst also seamlessly designed for logistics handling.

# Service overview

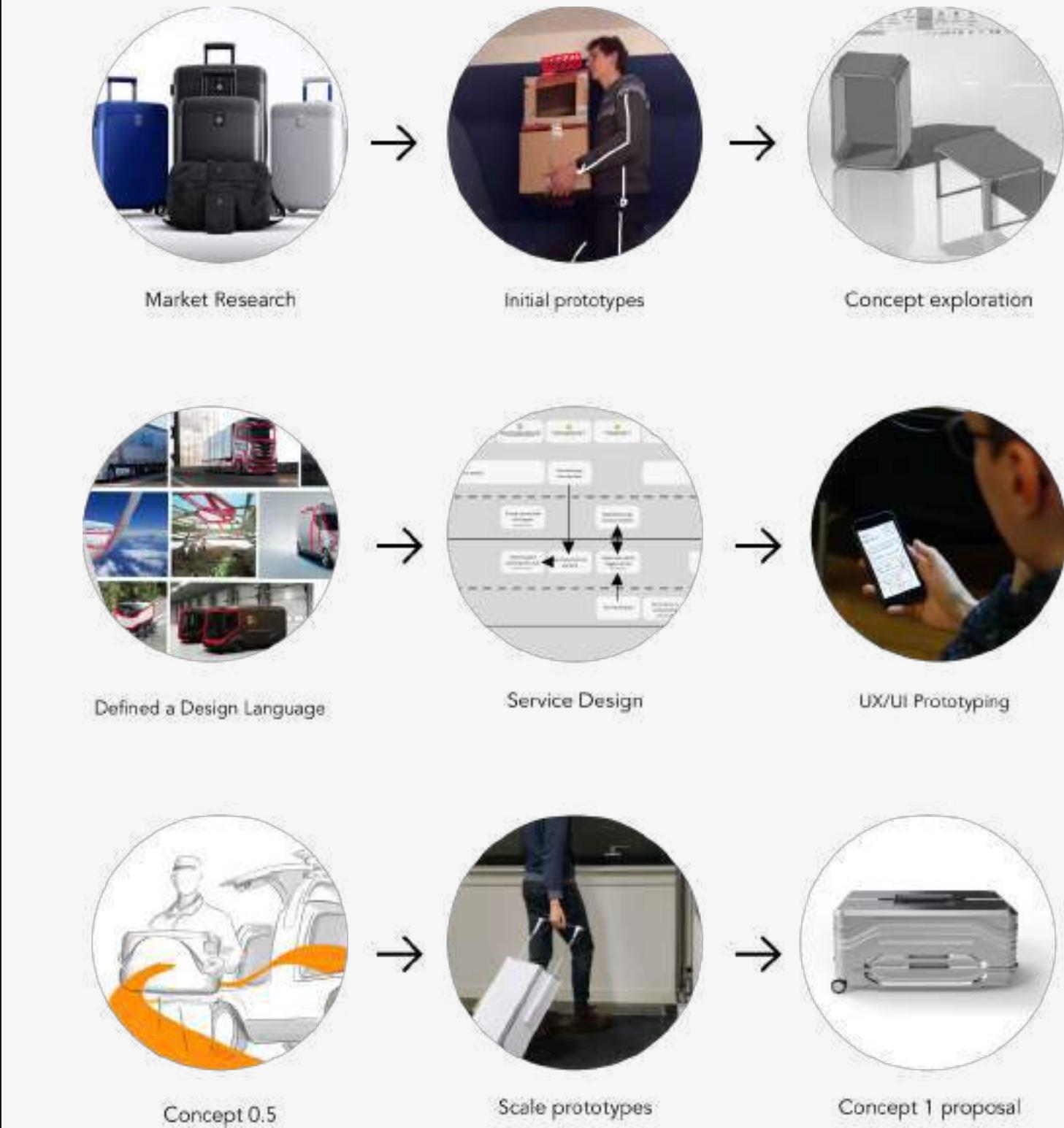


# Where we left off...

## Semester 1 Overview

This section will quickly cover the work conducted in semester 1, the outcome and resultant feedback.

A significant amount of insights and user trials have already taken place in semester 1. Which has greatly supported the work highlighted in semester 2.



# Concepts explored

## Semester 1

### Owned by the traveller

Shifts the cost of ownership onto the consumer.

Requires the design to accommodate both travel with/  
without the traveller.

Must consider how it might be stored in the travellers home.

Restricts a travellers ability to use this service if doesn't own a case.



### Compact

The compact storage of the product at home.

### Storage

Using the product as a storage solution for when not in use at home.

### Part of living space

A product which blends as part of your living space. Pack and leave when travelling.



Further concept development

This decision has been made through interviews and evaluations with target users. They were asked to prioritise what they felt was most desired.

Further concept development

Final proposal

## Semester 2

### Owned by the service

Ability for the traveller to tailor the number of containers to their needs.

Removes the cost of suitcase ownership on the traveller.

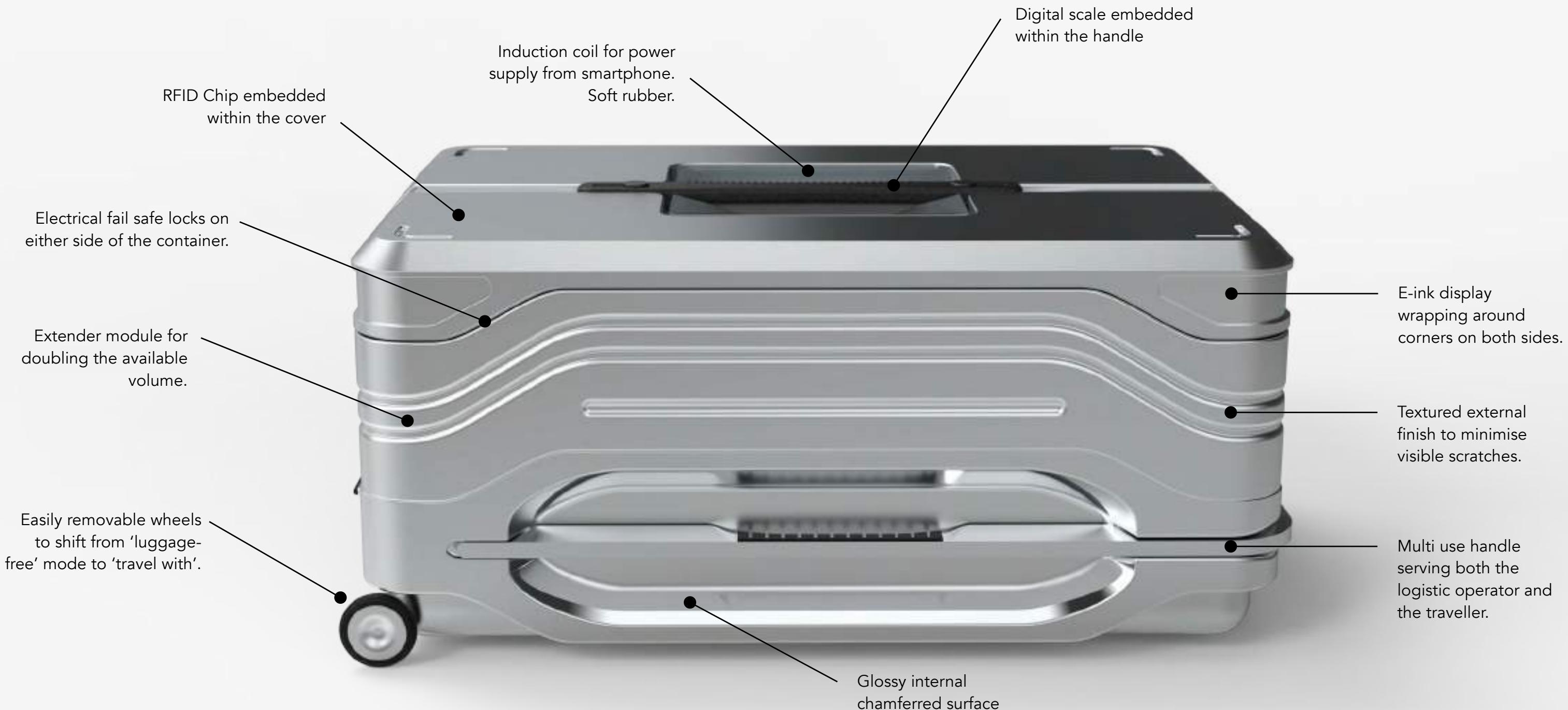
The service provider has control over any hardware updates/upgrades.



### Optimised for service

A design who's primary focus is to seamlessly enable the service. And support the delivery of travel and non-travel items

# Summary of Concept 1



# Summary of Concept 1

## Stackable

Accessible handles on all visible sides.



## Modular

Double the volume with the extender module or divide with compartments.



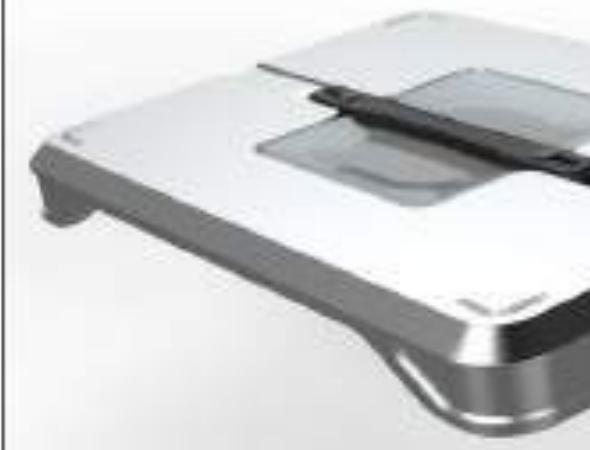
## Multi functional

Transforms from a service optimised product to a travel optimised mode.

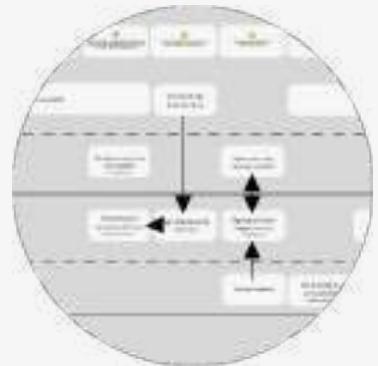


## Latest technology

RFID, E-ink and Digital scale all enabled without an internal power supply and contained within the lid.



# Concept 1 Feedback



A simpler, more effective communication of the scenario is required.



The modular system isn't compelling enough with concerns over its overall benefits and convenience.



Concerns regarding the ergonomics of having the scale embedded in the handle at the top.



Concerns regarding manufacturing, with many undercuts posing potential problems.



Make use of personas to develop a more defined specification



Room for improvement regarding the aesthetic styling of the case.



Manage the balance between aesthetic styling and function. A simplified approach may be needed.



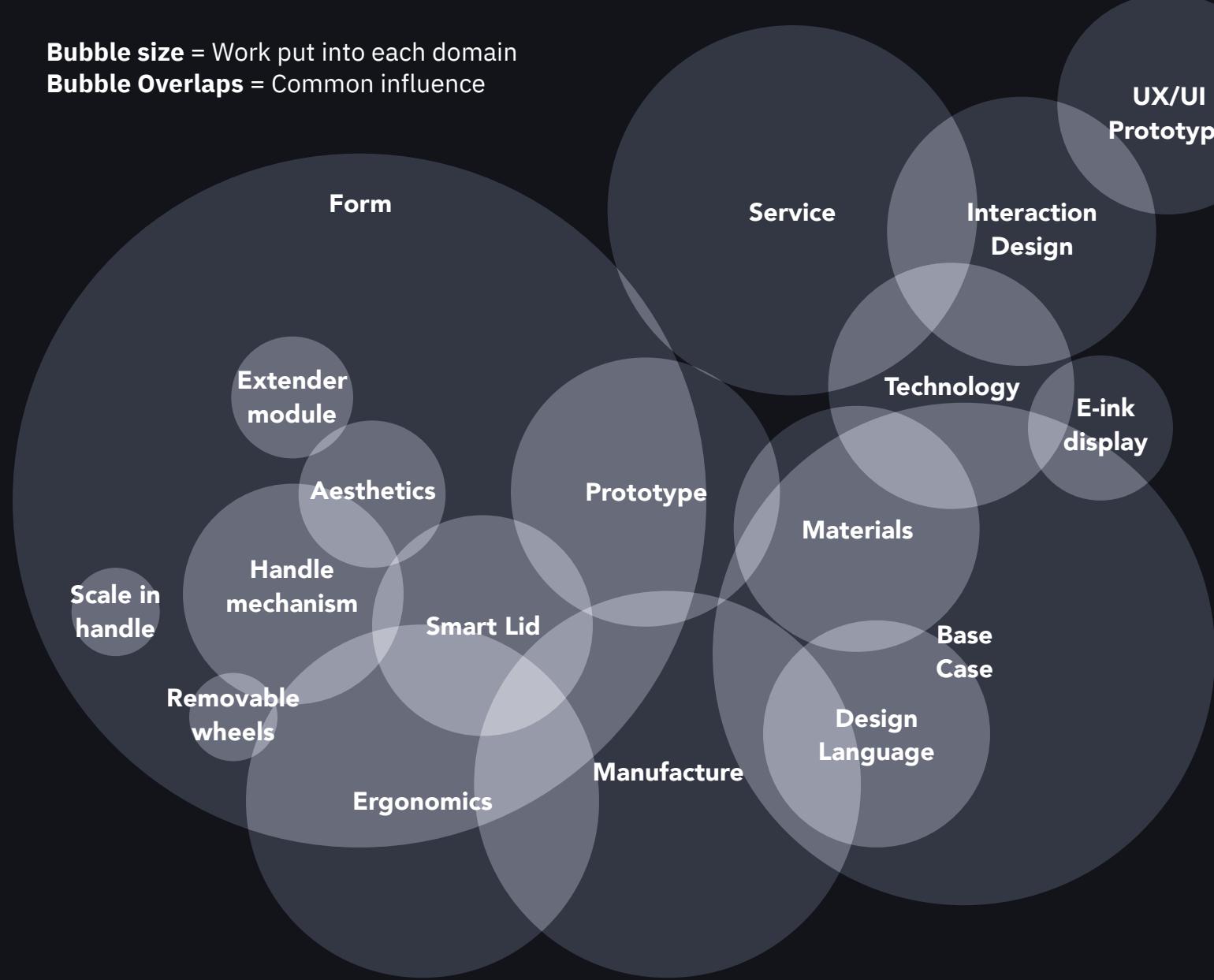
Look at improving the flexibility of stacking orientations.

# Semester 2



**Bubble size** = Work put into each domain

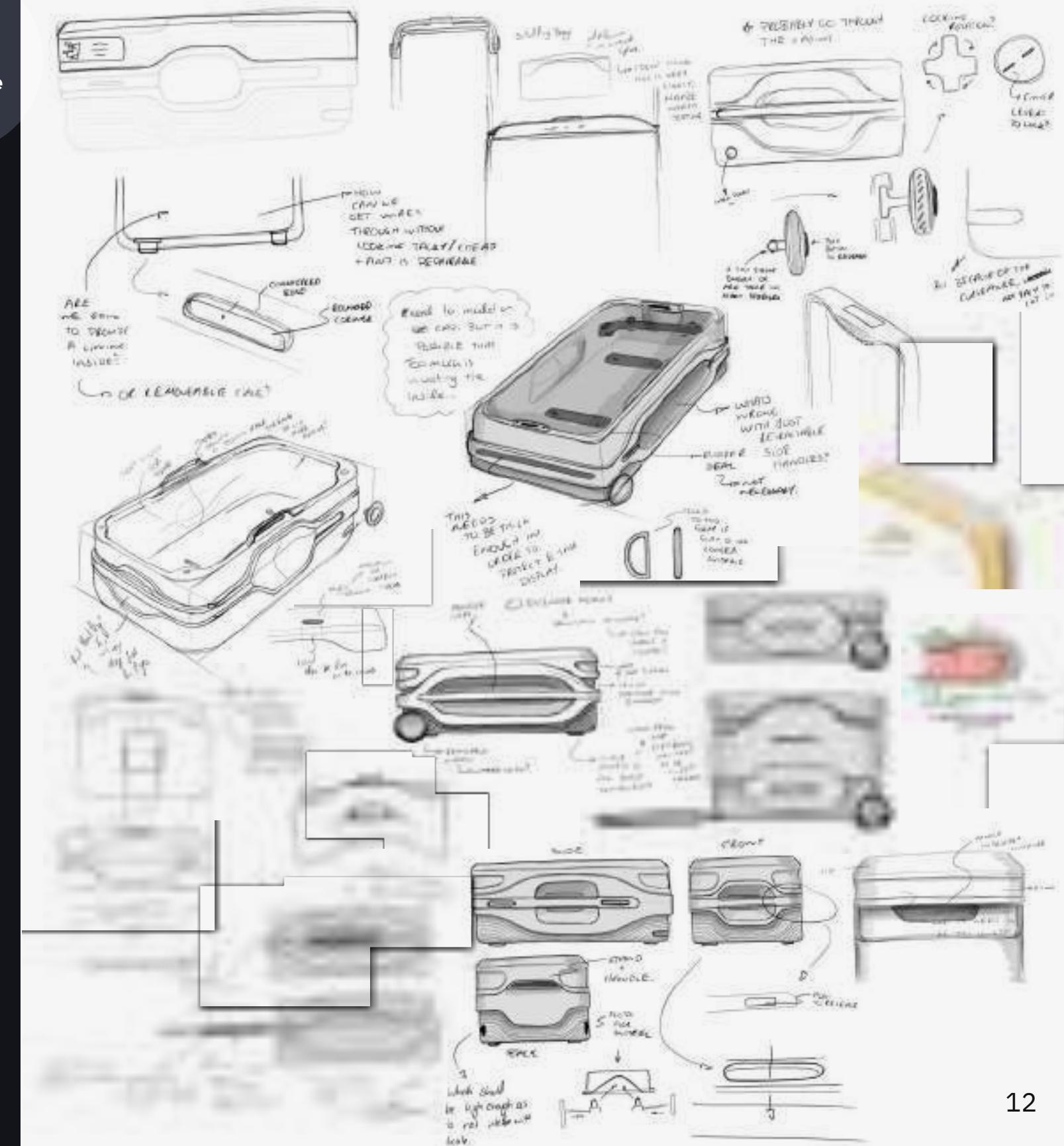
**Bubble Overlaps** = Common influence



# Concept 1

## Further Development

Building upon the feedback generated from semester 1, further emphasis was placed on developing the feasibility of the proposal. Detailing certain interactions such as the retractable handle component, or the removable wheels. A focus on manufacturability was also established and considered in a simplified design form.



# Lo-fi Prototypes

Created to quickly iterate on features. Evaluating scale was the primary reason for many of these prototypes.



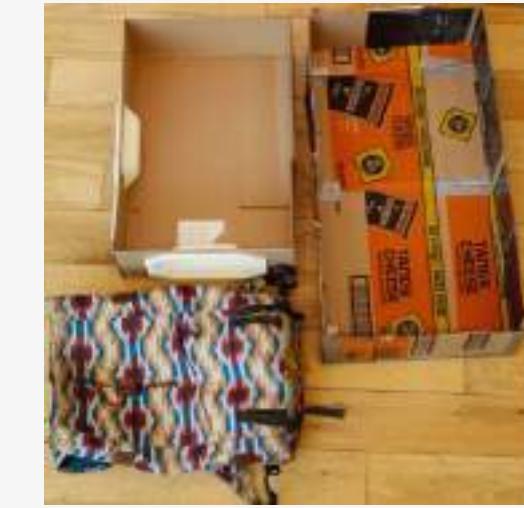
It was realised that the dimensions were far too small and that physical modelling was vital in order to make CAD dimensions tangible to users.



Revised dimensions allowed for further components to be embedded and test for available volume.



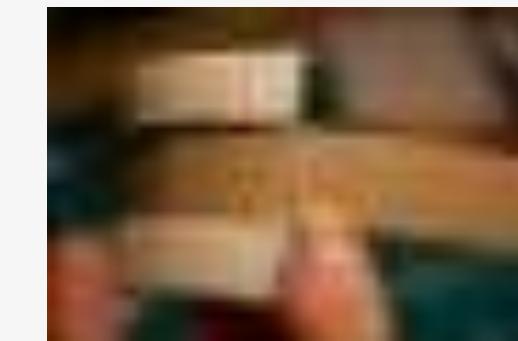
A more rigid model was created in order to better simulate the handle & wheel mechanism.



Concerns about dimensions were then evaluated through differently sized boxes. The box on the right was significantly larger, and did not feel proportionally appropriate. This helped establish that the left container was most appropriate.



A handle bar from an existing suitcase was disassembled to understand its mechanism using push pins. A simple, yet effective mechanism. But couldn't work on wide handle bars as well...



There was not much available space for the hand to wrap around without being met with the sharp corners of card. The flat handle profile also meant that pressure was being applied in uncomfortable areas.

The handle mechanism was also created in order to simulate the the “Spring lock” (Left image) and the handle clip (Right image) to securely stow the part.

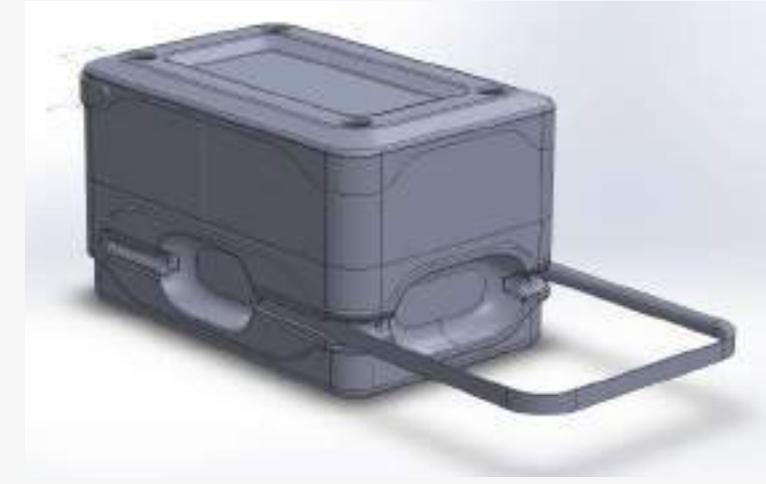


This helped establish the available space for the wheel attachment. Various wheels were drawn up to simulate attachment methods.

The prototype was also used to evaluate which finger position was most natural for fixing the wheel. One pleasant outcome was a button placed in the middle of the wheel, and when pressed, the wheel would lock up and you'd rotate the whole wheel to detach.

# CAD - Solidworks

The concept 1 was fully re-built in CAD to accommodate new changes to the handle structure and lid. This cad model was progressing towards being a fully manufacturable model and several components used for 3D printing.



Model with extender module and extended handle



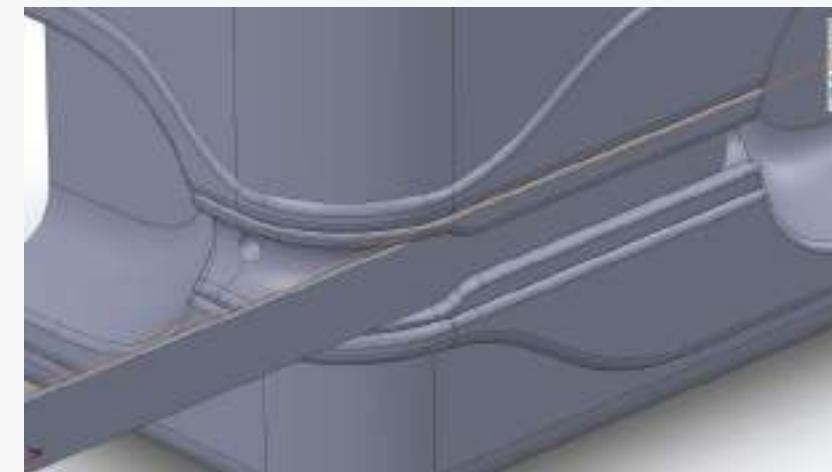
Split view of proposal

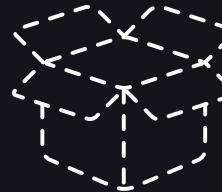


Compact model with stowed handle bar



Side profile





# Planned Prototypes

2 Major Scale prototypes were developed for this project. As well as several other accompanying prototypes such as electronics, UX/UI, Manufacturing and CAD.

Each prototype had a purpose for evaluation. Although due to the Covid-19 outbreak and the shift in concept, not every prototype was created as intended.

It was established early on in the project that an aesthetic model would not be appropriate due to the scale, cost and effort required to construct. This was an effective decision, further backed by the ongoing covid-19 outbreak.

Prototypes	Concept 1	Concept 2
3D Full CAD Render	✓	✓
3D CAD of all environments	✓	
Mid-fi / Hi-fi scale model	✓	✓
Wizard of Oz electric prototype	✓	✓
Hi-fi wheel model - Discontinued		
UX/UI Prototype	✓	
Manufacturing CAD Models	✓	
Stacked paper prototypes - Discontinued		
AR Prototype	✓	

# Concept 1 Scale Model

This model was the first dimensionally accurate scale model of concept 1. It included a retractable handle, an extender module and a lid. It was also designed to support adjustments for user evaluations.



Adjustable handle grips to tailor its height to the participants ergonomic preference.

Physical guidance was needed to easily secure the lid.



A 3D printed handle structure was added to the prototype. It raised concerns over the center of gravity (when an extender module is added) whilst also the uncomfortable nature of the flat rod.



A longer handle bar was required (feet always hitting the model) as well as the center of gravity is too high (always tipping the model over).



The extender module was awkward to store when not in use. It also felt structurally weak.



A wireless induction charger was taped underneath the lid in order to simulate the connectivity. It was not as easy to correctly locate the phone for an optimal connection.



The front dome was not appropriately formed when gripping the handle from above. The edge kept on pressing against the top half of the hand.



# A change in direction

This project has experienced several design iterations with two major concept outcomes. The first concept developed in semester 1 established the main form, function, interaction and materials of the project. The service has also been detailed in an initial service blueprint.

Semester 2 saw a shift in ownership for the product. This shift was beneficial for many reasons and provided an opportunity to create a product truly optimised for the service, rather than one capable of being carried by both the user, and the service.

The design language and key innovations of the 'case' project allowed me to transfer much of the work completed in semester 1 to the newly created concept 2. Further development was then focussed on the manufacturability of the proposal as well as key features such as the overall form, assembly and inner lining bags.



## Concept 1

### Owned by the user

A traditional model of ownership common in the luggage industry. Typically provides greater personalisation and consumer bond.

#### Disadvantages

Requires the user to purchase this product

Access to the service is limited to those owning this case.

Requires ability for product to be transported by user

Required ability to adjust the volume of the case

Unable to guarantee correct quality for logistics operators

Requires the user to store the case in their homes, taking valuable space.

## Concept 2

### Owned by the service

A new model of ownership rarely seen in the luggage industry. But follows a global trend towards shared ownership and sustainable consumption.

#### Advantages

Service is accessible to all. Allowing prospective customers to 'trial' the service without any commitment.

Removes the need to design for travel with 'user'

One standard size, and able to order multiple for the users volume needs.

Ensures quality for service

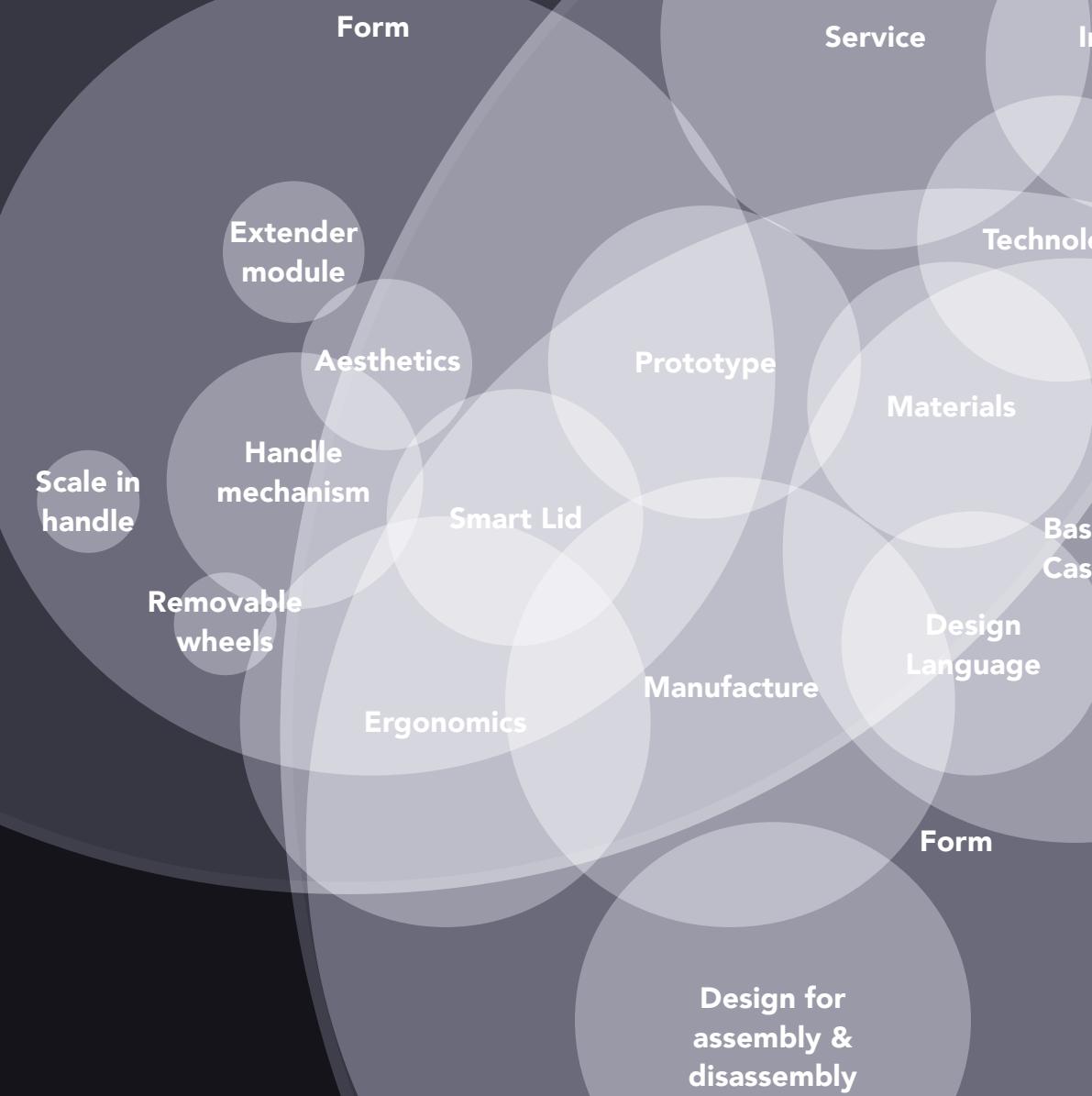
Ability for the service to update/tailor the cases as it grows.

Ability to provide / convey a more compelling user experience

When not used for travel, Case can be leased to parcel delivery services (Dynamically shifting its primary purpose based on demand)

# Concept 1

Owned by user

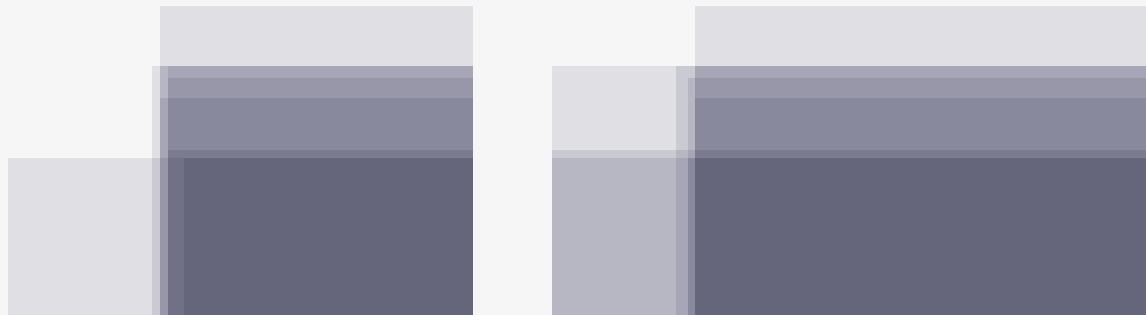


# Concept 2

Owned by service

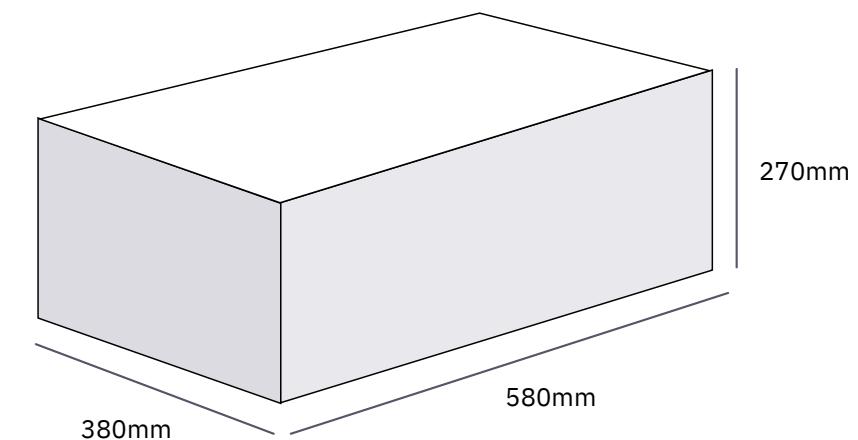
This page illustrates areas of common development for concept 1 & 2. The size of the bubbles indicates the time spent on development.

You will notice that some development from concept 1 has become discontinued, whilst new areas of development in C2 have arisen.



# Optimised dimensions

Initial dimensions had to be reviewed in order to better support this refined use case. There was no longer a need for an extender module, but most importantly, the need for users to travel long distances with the case.

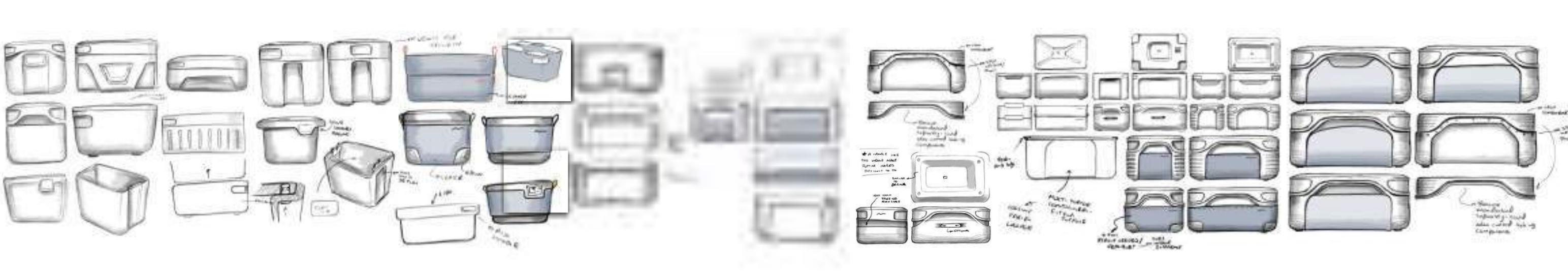


It was concluded that the dimensions laid out above were best optimised for concept 2. Ergonomic considerations were also made ensuring that a 5th percentile user could lift the case across its length (most common mode of lifting in the logistics / travel industry).

These core dimensions established the constraints for the overall proportions of the project.

<b>Optimised for</b>	<b>Dimensions (mm)</b>	<b>How many cases?</b>
Aircraft AKE's	1905x1534x1575	58
Small & Large courier vans	1488x1620x1244	38-65
Euro 2 Palette	1200x800x2200	32
Courier trolley	360x1145x200	2-4

Scale diagrams may be found in the appendices



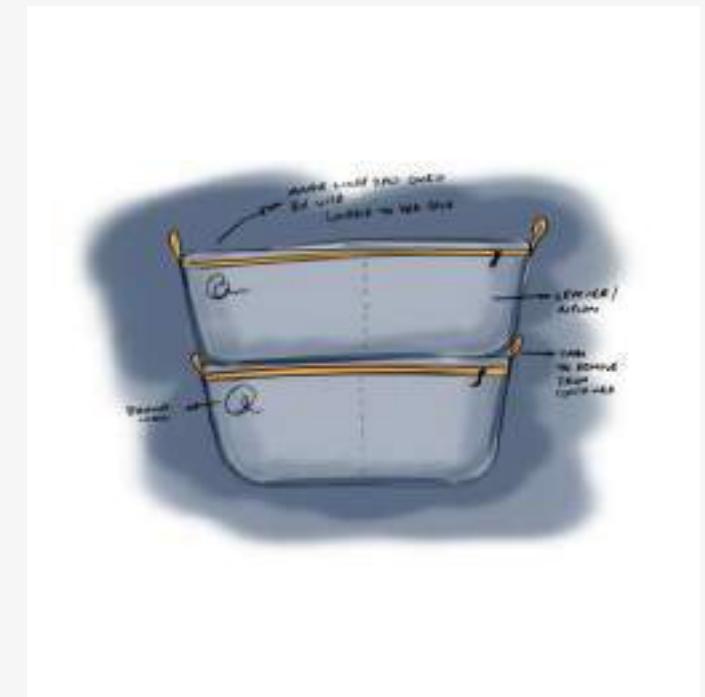
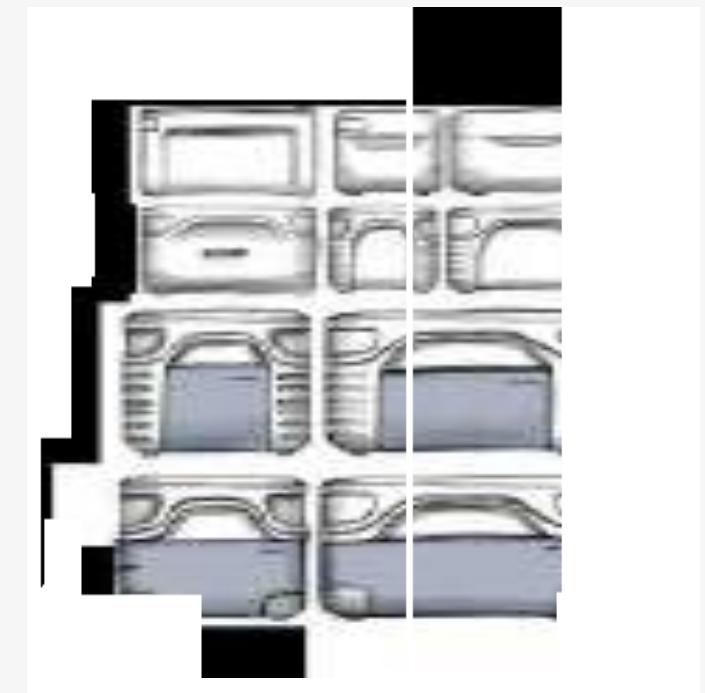
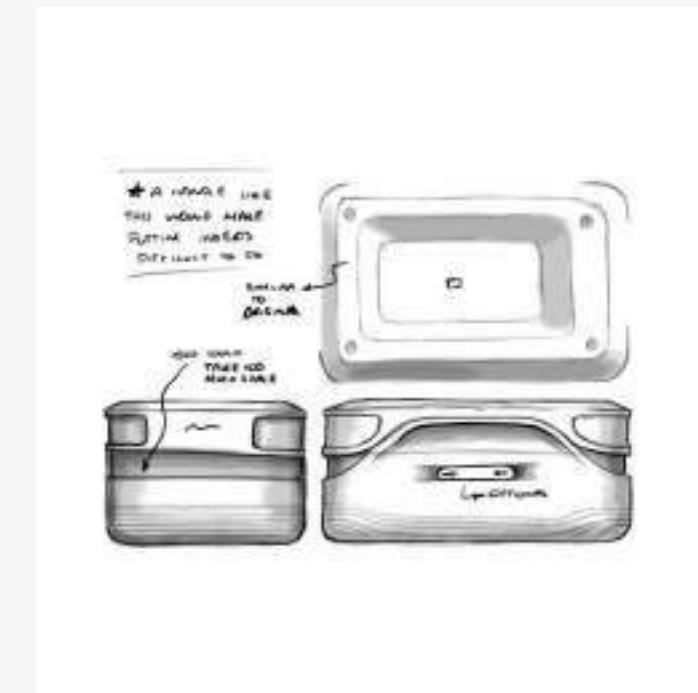
## Concept 2 Ideation

With the new model of ownership, complex restrictions were dropped (such as the retractable handle, wheels and extender module).

Key elements of the design language were carried over, particularly the curved “Smart Lid”. This form maintained efficient use of space with an e-ink display on all four corners whilst also keeping handles high (recommended for ergonomics). The re-design was also an opportunity to simplify the form and resolve manufacturing difficulties experienced in concept 1.

## Concept 2 Ideation

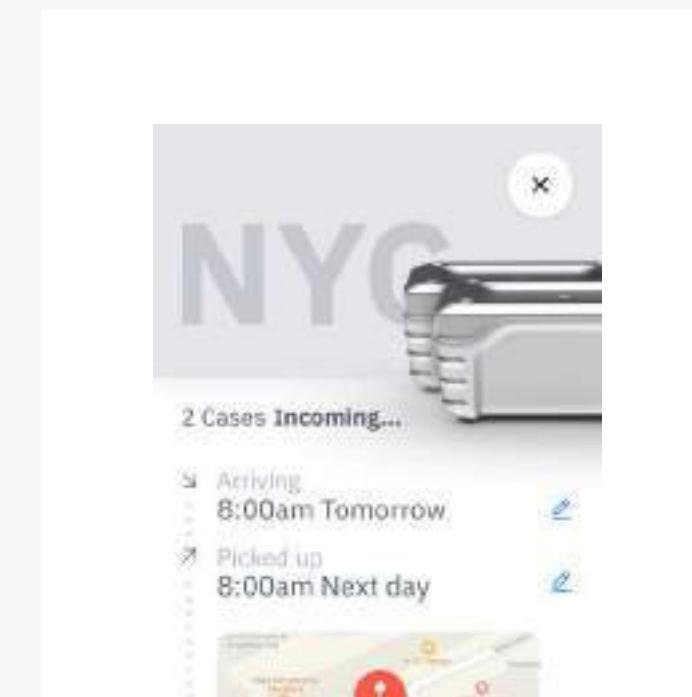
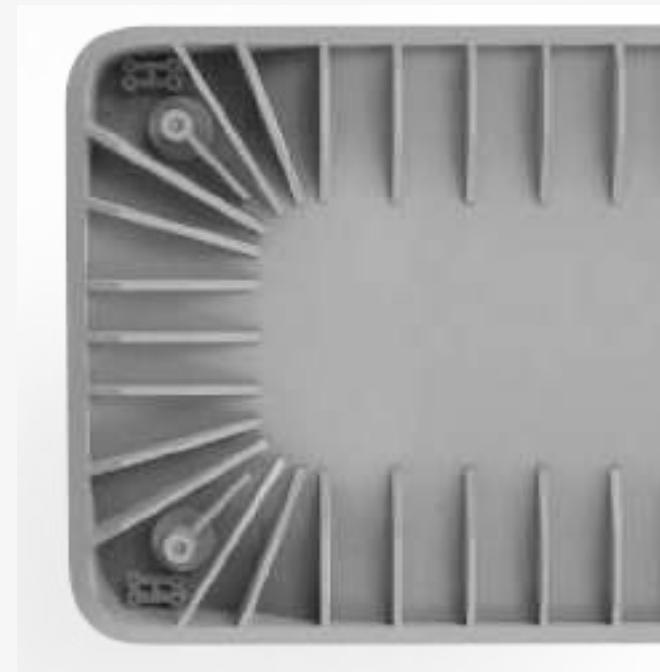
Ribs on each corner were included for added strength, whilst an inner liner was developed to enhance the travelling experience.



## Concept 2 Development

With a form direction finalised, development on key features of the UX, E-ink display, smart lid, inner linings and overall manufacturability was done.

The technology of the smart lid was then further modelled and iterated upon. A curved surface beneath the lid has been developed to house the display and solenoid locks. The injection moulded component was first modelled with 4mm wall thickness, but was later established that this was too thick and heavy for the product.



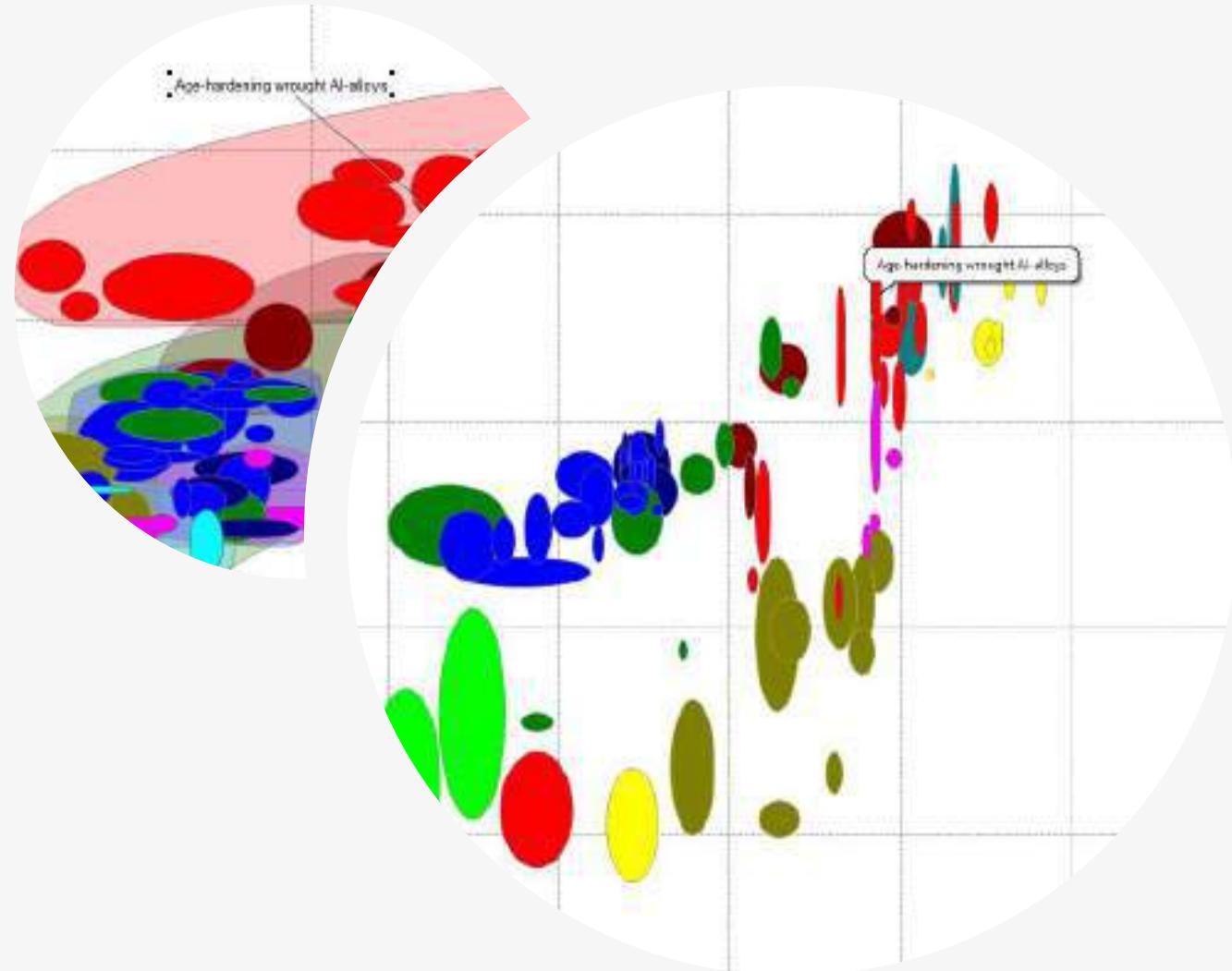
# Materials

Through discussions with Dick Heath, usage of CES, and analysis of competitor products, it was determined that Aluminium would be the most appropriate material for this project.

It is one of the best performing metals against the strength-weight ratio as well as being highly recyclable at end of life. As these cases will be continuously used, and experience rough handling, it is important that these two requirements are met.

To minimise environmental impact, and facilitate recyclability at end of use, this project only uses four different material types:

- | 3mm Aluminium sheets
- | White ABS for 'Inner lid' and 'Scale components'
- | Clear Polycarbonate for E-ink display covers
- | Elastomer for handle grips



## Metals considered:

### Wrought Magnesium Alloys

2/3 lighter than aluminium, but as strong  
Limited manufacturing processes  
Concerns about flammability  
Expensive in comparison to Aluminium

### Age-Hardening Wrought Alu-alloys 7000 Series Aluminium Alloy

High strength aluminium  
Chemically stable  
Resistant to cleaning chemicals  
Non-flammable  
Fully recyclable



Concept 2

# Prototypes, Evaluations and findings

With a new concept developed, new prototypes had to be made as well as evaluated.  
Many of the prototypes build for concept 2 were in the midst of the covid-19 outbreak and  
had to be adjusted to support new methods of working and evaluation.

## Prototypes developed

MDF Scale model

Augmented reality model

Electrical Wizard of Oz

UI/UX Interaction prototype

CAD Model + Aesthetic Renders

Design for manufacture

## Channels for evaluation

Website + Online Survey

## Respondants

35

Physical interactions with family members

4

Physical Interactions with students (Pre-corona)

8



## Concept 2 Scale Model

A second laser-cut MDF model was built in order to reflect the new design direction and dimensions.

This model was kept flat-packed and then built at home in Amsterdam. Valuable evaluations on volume, interactions, tech and ergonomics could be done.

A basic level of technology was embedded within this model in order to simulate the “Update” and “locking” user interaction.

This model also allowed me to use various sets of travel items to evaluate whether the available volume is appropriate for the use case.

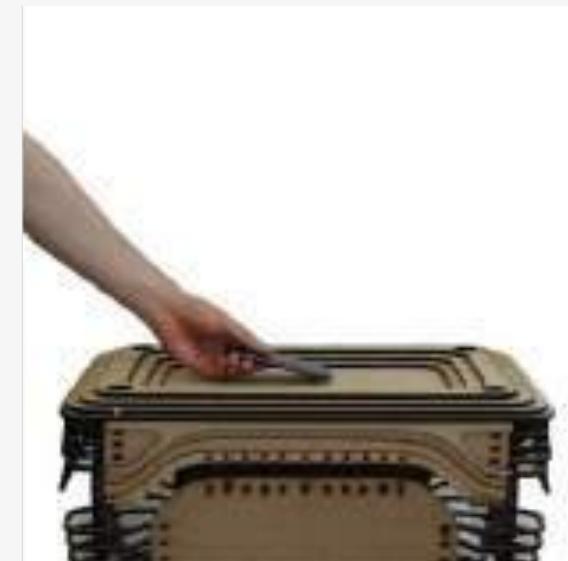


Concerned by sharp edges around the lip of the case.

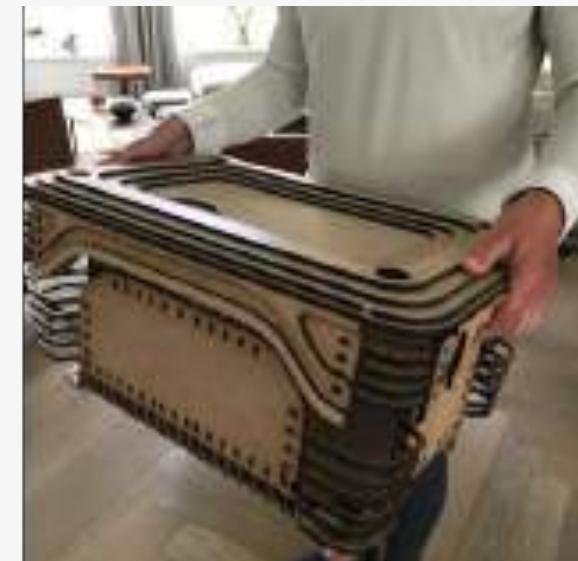


Initial concerns about size, but have warmed up to it when realising that multiple cases can be ordered.

Easily fits within the household, and doesn't make a dominant presence in the living environment.



Need to be clearer that the center of the lid is the location to place your phone.



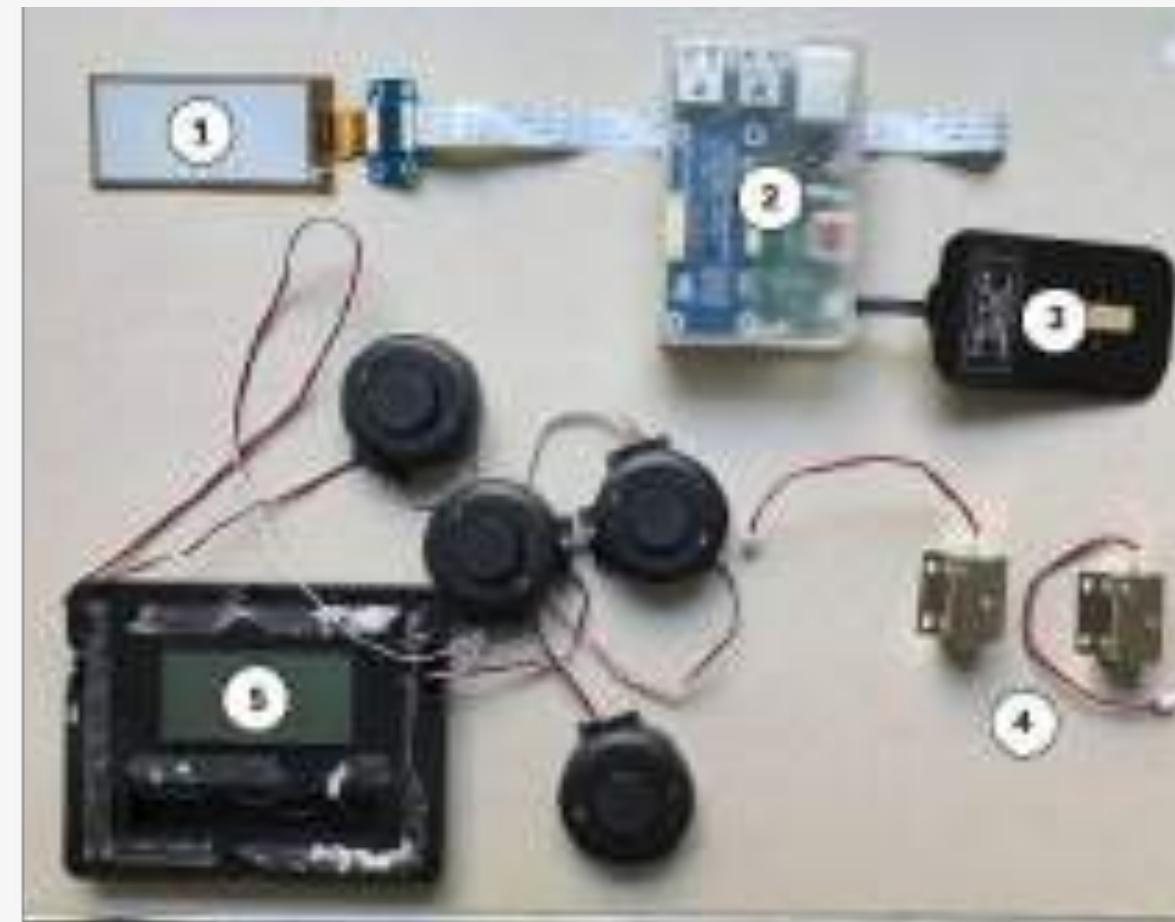
Size generally easy to carry and lift. Longer edge much more popular than the shorter edge.

Handle points not perpendicular enough. Should be more angled.



Corners as an opportunity for side pockets making most use of the available space.

The ‘feet’ of the product (Digital Scales) were 3D printed to evaluate scale and fit.



The scales give different readings when on a carpet. This is difficult to design around and is something that every scale suffers from. To work around this, the service should ensure that users correctly record the weight of their case, or face a fine.

# Electrical prototype

A block diagram may be found in the appendices

A basic electrical prototype was also developed. This helped enable a wizard of oz prototype aimed at simulating the user interactions with the product.

## Electrical components:

- E-ink display (1)
- Raspberry Pi (2)
- Induction charger receiver (3)
- 4 Solenoid locks (4)
- Electronics from Scale (5)

## The electrical prototype raised the following points:

Locating the induction coil is a bit more challenging than anticipated.



The e-ink display reads well and can easily be scanned with a mobile phone.

# Augmented Reality

An AR prototype was then also developed to circumvent the recent user test restrictions.

This model was sent to users of various demographics aimed at evaluating their first impressions of the product.

The main outcome of this is the users perception of size. From the feedback, it's indicated that the volume is a bit on the smaller end. Whereby users expect to take multiple cases when travelling for longer than 3 days.

It's also been mentioned that the curvature of the inner lid gives a good perception of it being strong and rigid.

When projected on the MDF model, it seems very natural to have the case stacked.

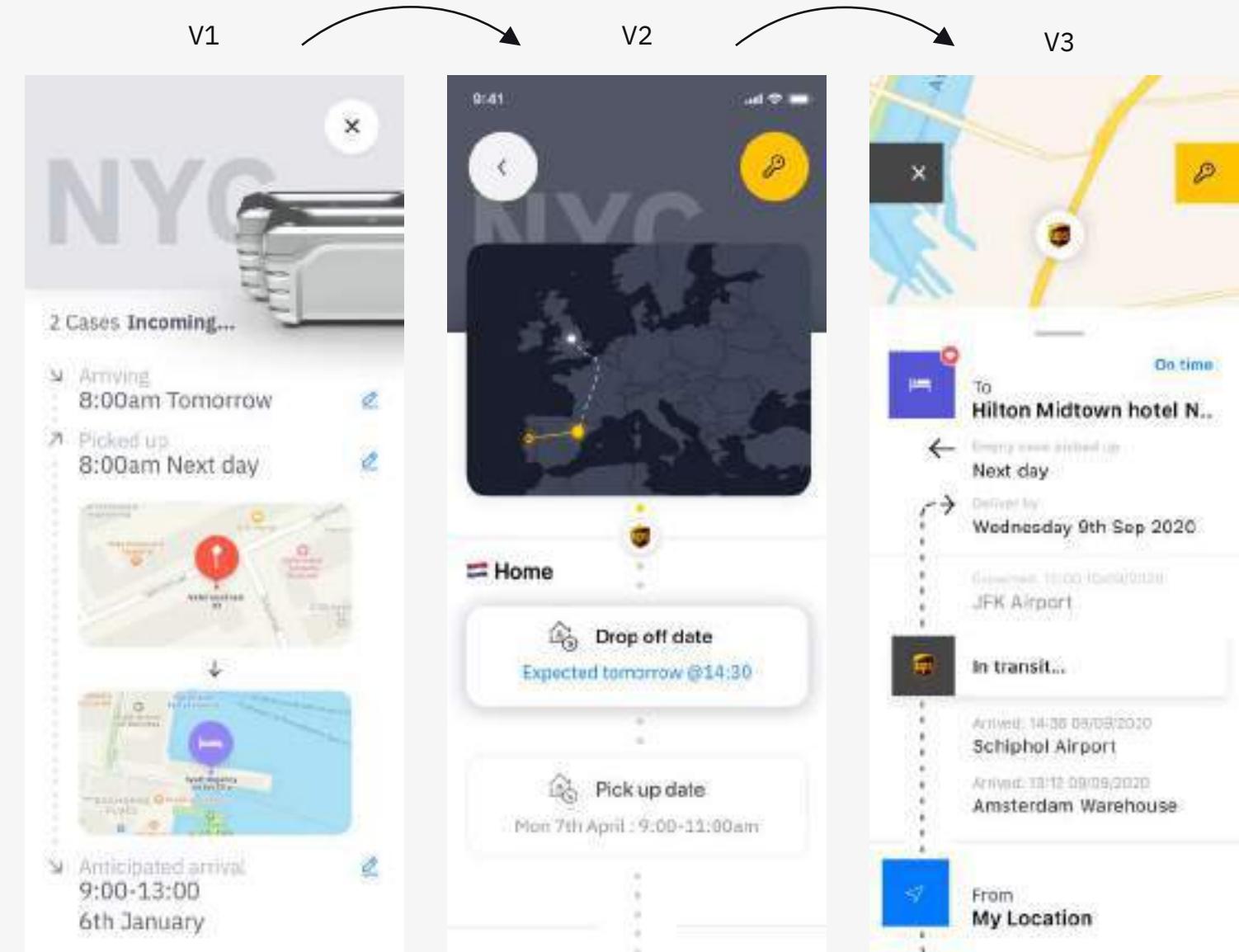


# UX/UI

This was developed in various levels of fidelity aimed at simulating the interaction between the physical product and the service.

## From evaluations:

- | Participants wanted more tracing capabilities. Then actually needed.
- | Easier access to customer support
- | Looks very “Apple at the moment”
- | The process of actually booking the case is too long and should be better optimised / automated
- | There isn't a need for the case imagery
- | Users struggle to know which size to order (this can be fixed through the use of AR to measure the optimal form).
- | Ability to share a key (if phone is lost or the shipment is for someone else).
- | “How do I know which hotel accepts case?”
- | Am I able to send my Case to a residence with no-one there?



**Add a case**

Choose with AR

Small (23kg)

Add Premium travel + £3

Medium

Large

**Select**

**Add a case**

Choose with AR

Small (23kg)

Add Premium travel + £3

Medium

Large

**Select**

**New trip found**

**Current**

To Hilton Midtown hotel N..  
Deliver by Wednesday 9th Sep 2020

**Upcoming**

To Hilton Midtown hotel N..  
Deliver by Wednesday 9th Sep 2020

**Deliver to?**

Search

Hilton Hotel, New York

Hilton Hotel New York

Home Salzburg

Home Amsterdam

Previous Destinations

# CAD

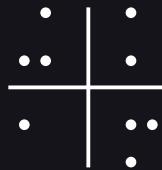
CAD prototypes were developed in order to evaluate the aesthetics of the product.

## From evaluations:

Generally the overall form of the product was well received and labelled as both 'nostalgic' of the "golden age of travel" and 'futuristic'.

Several concerns on the external leather 'skin' were raised stating that it sent mixed messages on the true function of the case. Fearing that it would be damaged.





# Summary of Survey outcomes

A survey was developed in order to remotely evaluate certain aspects of the physical product design. A primary focus on the Case's available size, interaction and aesthetics was in place.

The survey was directly sent to individuals of various demographics experienced with travelling.

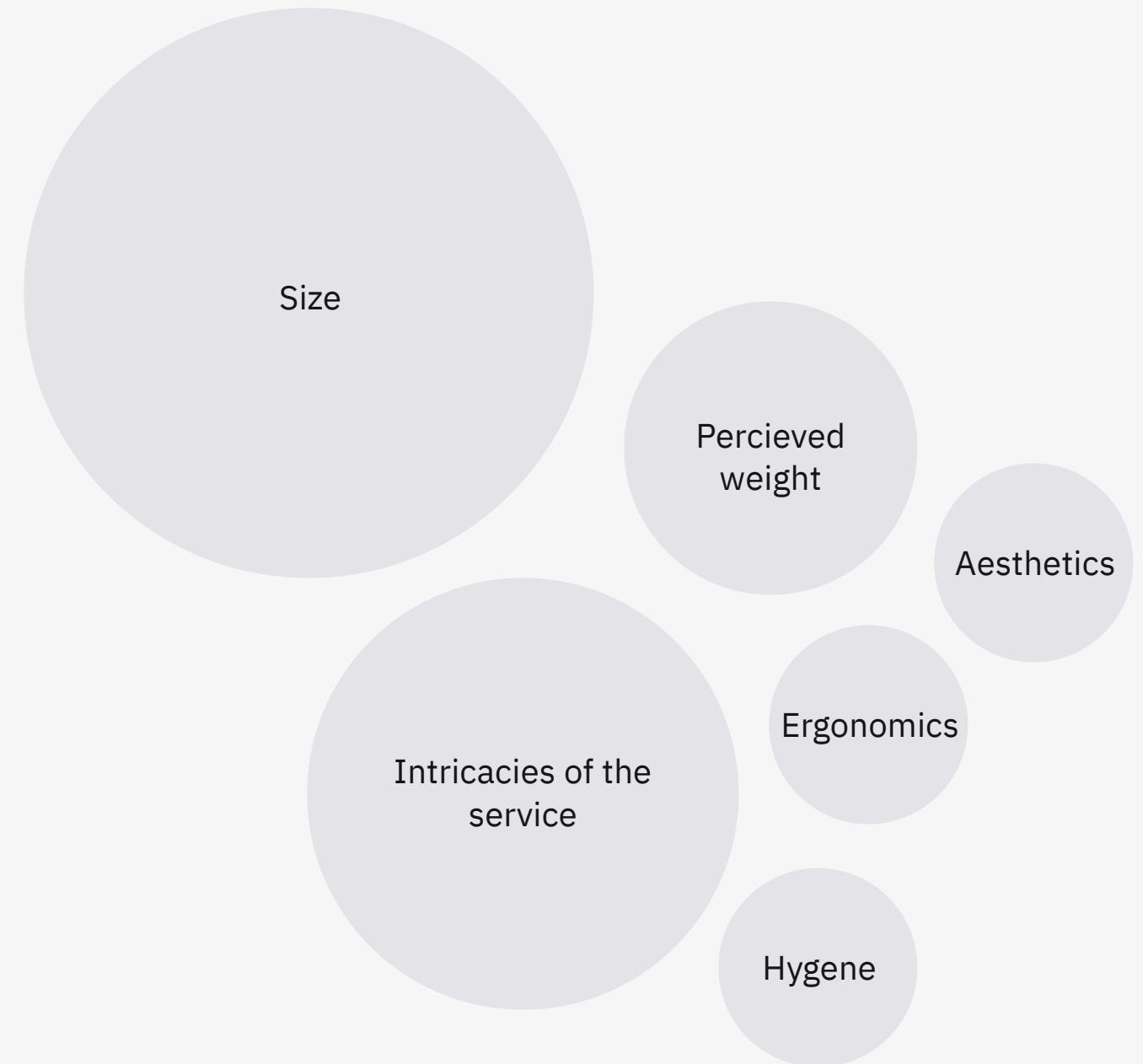
## Key words associated to product

Rugged Sturdy Durable Protective Secure Expensive Classy Sleek Elegant Minimalist  
Warehouse Metallic Robust Futuristic Stylish High quality Smart Medical Modern

**Functional** - Optimised for logistics

**Aesthetic** - Optimised for living environment

It is positive to hear that the product is viewed as "Clean" "Stylish" "High quality". Although this may also come as a hinderance to the overall perception of the service. Additional keywords such as "Expensive" and "Luxurious" indicate that this service could be perceived as something only accessible to the "wealthy" potentially deterring family travellers. The removal of the external leather skin could help balance this disparity.

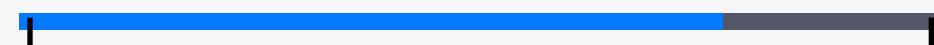


## Raised Concerns

# Survey outcomes



## Inner cases



**Positive response**

**Neutral/Negative**

Generally very positive responses. Participants like the opportunity to organise their contents due to the fear of having items move around the case. Participants have asked for various types of liners with different functions and materials. Some participants would rather travel “naked” without any liner.



## Travelling ‘Naked’ (No liner)

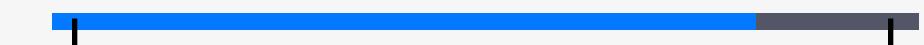


**Positive response**    **Neutral - Prefer with liner**

It's been identified that travelling ‘Naked’ is a good opportunity for first-time users to “trial” the service. Nevertheless, many participants would prefer to use a liner to securely protect their belongings whilst maintaining hygiene. Some have also expressed concerns of scratching the aluminium case.



## Smart Lid



**Very convenient**

**Not so much**

Very positive response towards unlocking the lid with a smart phone. Although some concerns regarding privacy and functionality of the key.



# Further findings

Prior and throughout the release of the survey, several informal interviews & user trials were conducted in order to gain further feedback.

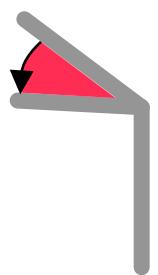
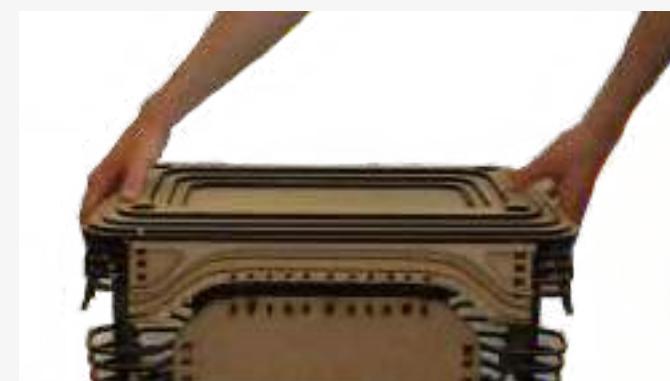
# Further findings

## Physical product

In almost every participants first impression. Their initial concern is the size of the product (too small). Typically, Luggage is seen as a large, buky and inconvenient item and participants expect this. The majority of participants have mentioned that the available volume is probably most appropriate for trips of 2-3 days. A second 'case' would last users 6-8 days and a third case would be used when travelling "back home" from university or living abroad.



As the digital scale was now placed at the base of the case, it was noted that this limited a users ability to slide, and stack like a typical box.



As participants interacted with the scale model, it was noted that several struggled to gain enough grip at the handle positions. A steeper angle was recommended.

Another concern is the fear of the edges being too sharp. This is a very important consideration and should be addressed. At present, the lip is a hard edge and could at a minimum be rounded.

# Further findings

## Service design

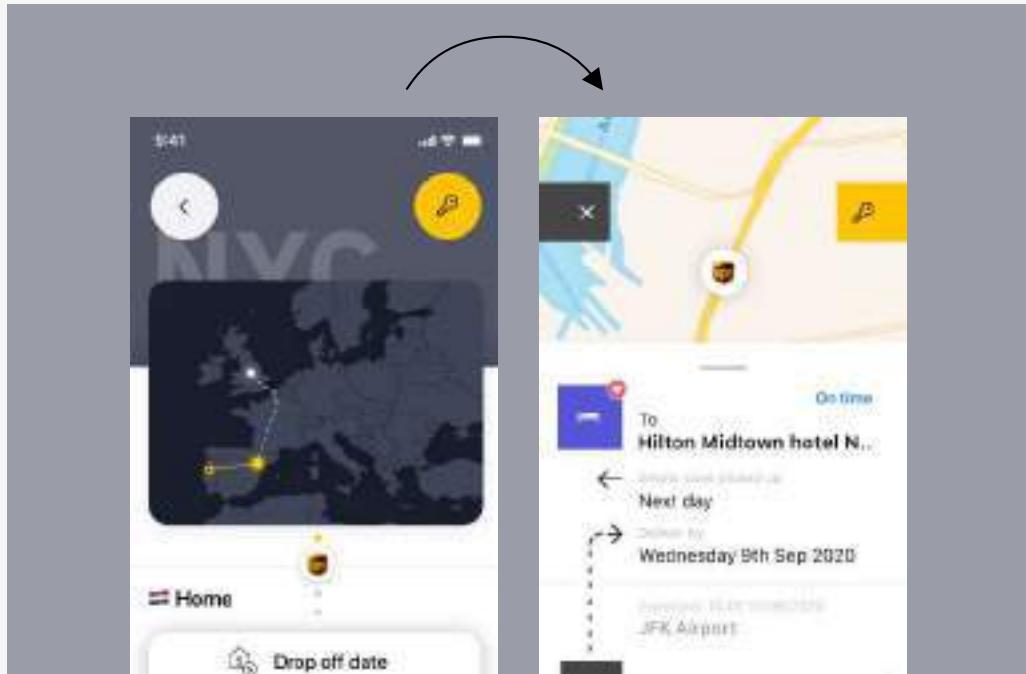
- | There is a general opportunity to improve the communication of the functions of the service.
- | Due to concerns of the volume available in the case, many participants have asked whether or not several cases could be provided. This is a possibility, but not clearly communicated enough.
- | Participants have also asked how the service will be advertised and promoted, and whether there could be an opportunity to partner & integrate with travel / accommodation services (Like cruises) to support this.
- | Concerns were also raised by the growing trend of travellers using Airbnb as holiday accommodation as opposed to traditional hotels.

Typically Airbnb's are not resided and locked with a key pass. With no-one able to receive the case, how could it be delivered before the traveller? Amazon has circumvented this problem through obtaining key pass information from residents. This service could employ a similar model.

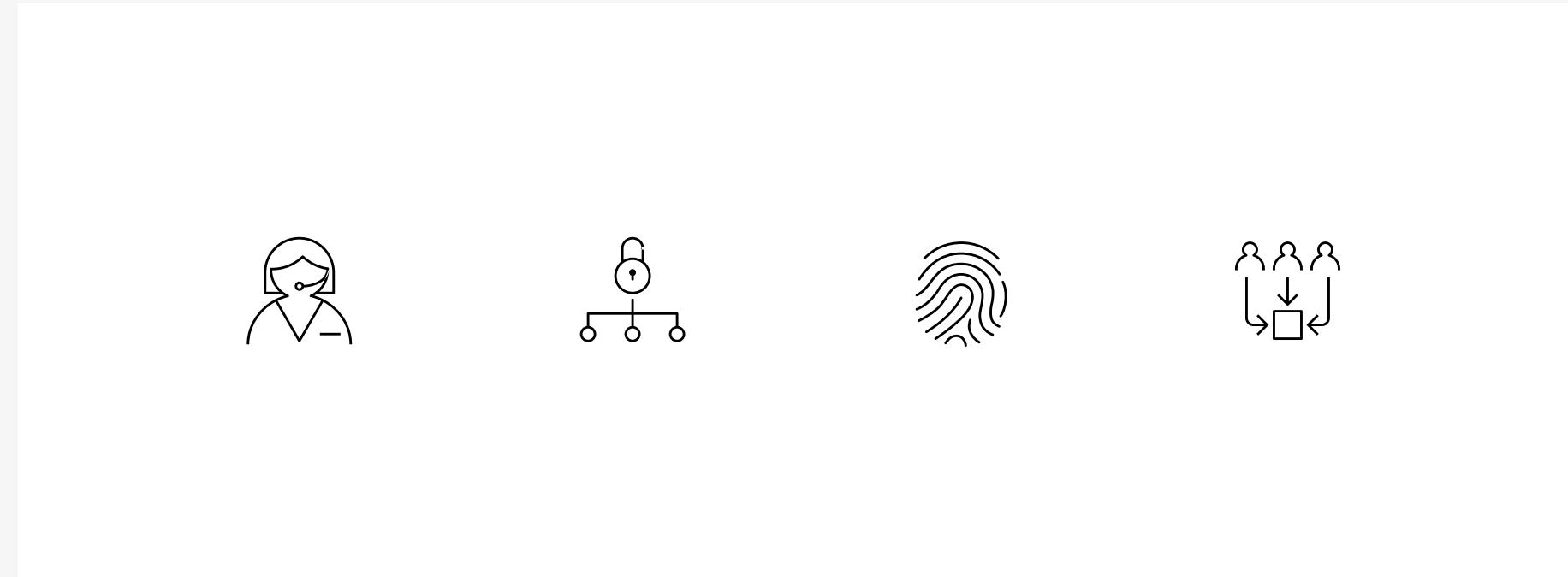


# Further findings

## UX/UI Design



Participants tended to request for more tracking information than actually needed. Seeing detailed progress reports of their case instilled greater trust and transparency with the system.



Successfully shipping personal items is vital in order to maintain a pleasurable experience. There is nothing worse than starting your holiday with a lost suitcase. With this in mind, it's important to provide quick and direct access to support if something does go wrong. This has not been highlighted enough in the interface and should be improved upon.

It has also been identified that there is a strong need for users to share their digital key of their Case with another individual. This resolves concerns about being unable to unlock if a phone is lost, or the ability to ship a case to someone else.

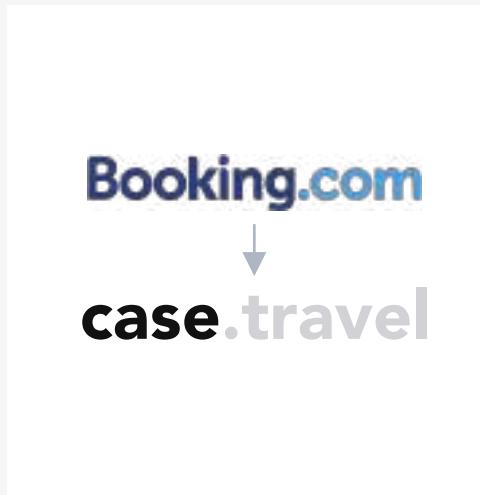
Privacy and security has also been a major concern for participants. Questions were raised as to how much personal information was stored on the case and if something were to be lost, how privacy and security could be ensured.

When using the interface to make a booking. It would be good to have a feature indicating which addresses are automatically registered to accept case on behalf of the user. This has been highlighted in the user trials whereby users hesitated when selecting an address as they weren't sure if there would be someone to accept their belongings.



# Further design changes

# Immediate changes



## Design Language

Adjust the design language of the service in order to make its appearance more approachable to mass market users.

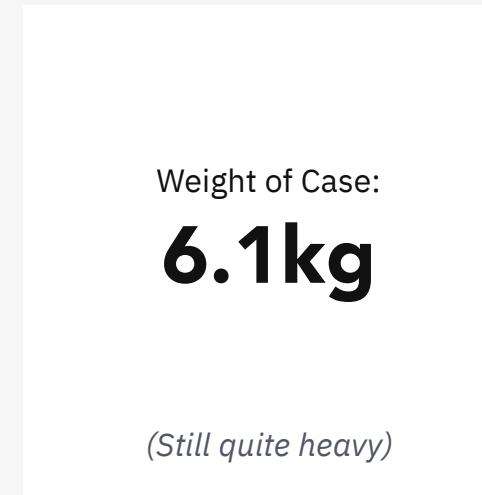
Brand taking inspiration from booking.com, through approachable and familiar terminology.



## Size

Address concerns with the size of the case through adding clarity within the UI interface.

Use AR as an opportunity to measure the required volume, and have Case recommend how many is needed.



## Weight

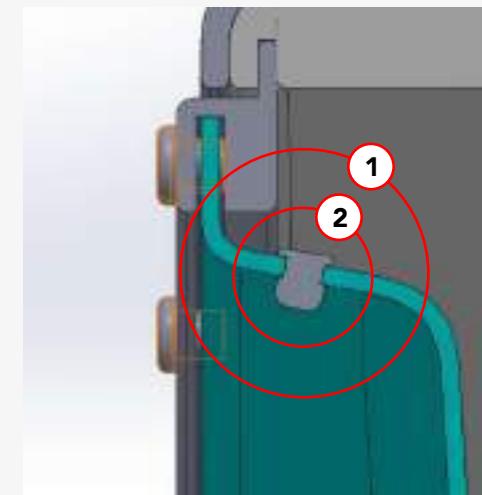
A reduction of wall thickness from 3mm-2mm enables a 1.6kg savings.

**Market competitors:**  
Eastpack 3-4kgs  
Samsonite : 4-5kgs



## Weight

Added a 2mm fillet throughout the edge of the aluminium lip to minimise the risk posed to users from sharp edges.



## Ergonomics

Improved ergonomics of the handle points through creating a sharper angle (1) and adding a rubber ridge for added grip (2).



## External Leather

The external leather wrap has been removed to simplify the aesthetics and function of case.

# Long term / Outstanding changes



## Digital Scales

Adjust the design of the digital scale in order to improve ease of handling & sliding.



## Multi-Case differentiation

When multiple cases are used, explore how these cases could be differentiated by the user through the E-ink displays.



## Service partnerships

Explore how the case service could be embedded in other websites as a widget.



## Differently sized cases

How might the portfolio of cases expand to support more specialised items / volumes?



## Polymer lining

Evaluate whether or not a polymer lining is required to protect the inner case surface from damage by user's items.



## Connectivity of scales

One element which has not been successfully resolved is the connectivity between the lid and the electronic scale at the base.



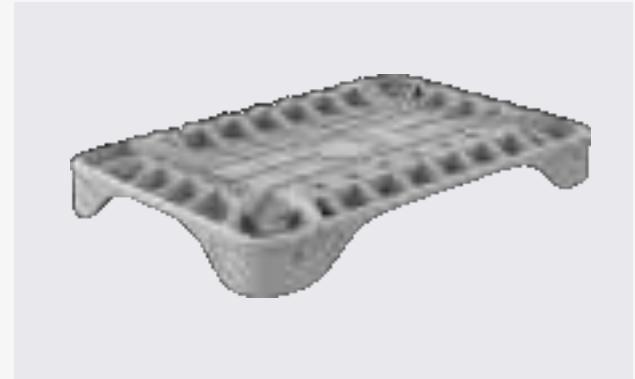
# Design for manufacture

Various manufacturing methods have been considered for this project. The 'Base Case' is a complex unibody form which required additional effort in identifying the most reasonable process.

## Overview



**Lid :** Stamped



**Inner Lid :** Injection Moulded



**Lip :** Die Cast



**Scales :** Injection Moulded



**Base Case:** Hydroformed

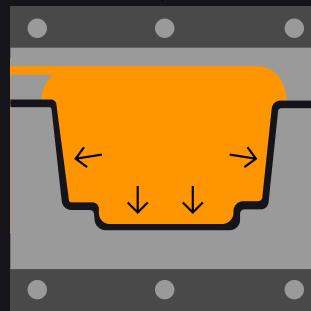
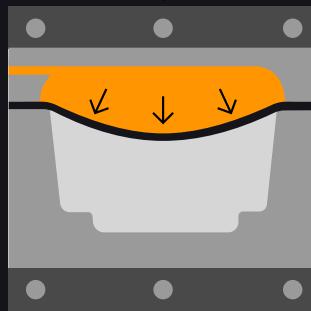


**Rubber Grips:** Injection Moulded



# Hydroforming

Hydroforming is process similar to that of deep drawing, but uses high pressure hydraulic fluid as the equivalent to a traditional “Die” in stamping (Similar to Vacuum forming).



## Key Facts: (Nakagawa et al.)

- | Takes place at room temperature
- | Complex geometries can be achieved
- | Less material needed per part, saving money and weight
- | Common in the automotive industry

### Finished parts:

- | Are strong, rigid & light
- | Have a higher stiffness-to-weight ratio and at a lower per/unit cost than traditional stamping
- | Have a superior surface finish on side of hydraulic fluid
- | Have improved thinning consistency with 50% less material thinning than conventional deep drawing.
- | Have an increased dimensional accuracy

### Cost

- | Ideal for mid-level productions of 10,000-50,000 Units/Year
- | Low cost alternative to other metal forming processes
- | 20% Cheaper tooling costs than low volume stamping
- | 175% Cheaper than high volume stamping
- | Cycle times vary between 15-45 seconds
- | Typical tooling costs of \$640,000 (Compared to \$1,700,000-2,700,000 in traditional stamping methods)- For Die costs of 30,000 units/year
- | Costs is prohibitive at high volumes
- | Average production rate of 8 pieces / minute

### Specific to case

- | Need a blank of 904mm
- | Form creates a drawing ratio of 1.7 (Can achieve drawing ratios of 3.2 in one step)
- | 2,600,000 Newtons of force needed for this part



# Unlocking value

*Innovation has the ability to unlock value*



Unlocks the value of  
spare rooms in houses

Uber

Unlocks the value of  
unused cars

wework

Unlocks the value of  
office buildings

**case.travel**

Case will unlock the value that is currently locked in expensive luggage infrastructure across the travel industry.

**15%**

Increased passenger  
capacity on trains

Schiphol Airport - Samsonite

**£299bn**

Savings on airport  
infrastructure (Europe)

NEXTT Preliminary Cost Benefit  
Analysis (2019).

**1 Hour**

Reduced travel  
time on every trip

Future Travel Experience

## Combining the latest technology with innovative services

Like any other disruptive technology, it will take time for Case to become mainstream. But the economic forces will inevitably unlock its value. This product and service will naturally attract users because of its added convenience, competitive pricing and better performance against competitors.

### Why will Case succeed economically

Case will leverage the existing network of freight and courier delivery. It will require limited new infrastructure investment. With the exponential growth of e-commerce and home delivery, it is expected that these services will only get better, cheaper and more reliable. This is an inevitable trend and Case will benefit from this.

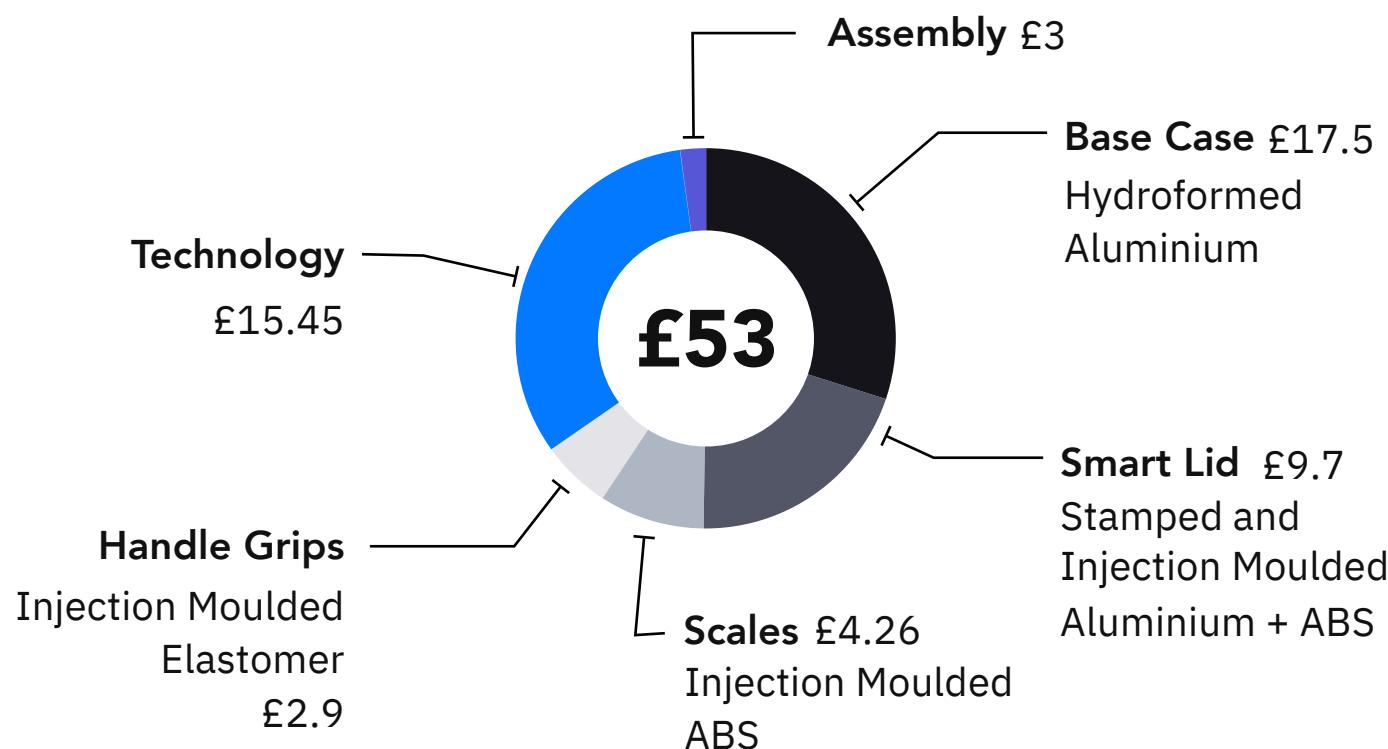
At the same time, Case will unlock huge potential saving for the transportation and travel industry. Airports and airlines are spending billions in check-in services and luggage handling infrastructure. By separating the luggage from the traveler, the airline industry will be able to reduce significantly the time spent travelling in airports. It will also be possible to reallocate a large portion of these spaces currently dedicated to luggage handling to the passenger. This basically means that the product and service has the potential to increase the capacity of existing airports, thereby generating huge saving for the airport operators, airlines and the community as a whole.

Similarly, in trains, the space allocated to luggage can be redeployed to travellers, increasing profitability and convenience. The same logic is true for other modes of transportation.

Case will also benefit from a long term “network expansion” effect. The cost for early adopters is initially expected to be higher than for those travelling with luggage. Case will be positioned as a premium service, highlighting the convenience and the innovation. But overtime, as the number of adopters increase, the cost of transportation will decrease drastically. We expect that at some point, given the economic forces at play, it will be cheaper to have your case travelling separately than to travel with it.

These changes will take time. There will certainly be a lot of resistance because the investments made by the incumbent operators are significant and the Case will be a threat to their profitability, but ultimately, the combination of traveler convenience and economic benefit means that the best technology will ultimately win.

# Costing



Full details on the product's costing may be found in the appendix.

## Assumption on cost of service

**Cost of production of Case :** £53

**Production target :** 20,000 Units/Year

**Lifespan of the Case :** 80 trips

**Average cost of delivery aligned with Express Delivery services :** average EUR 30 for 500k trips

*Early adopters will be ready to pay for the service for the added convenience on top of existing travel cost*

But for the service to expand to its full potential, it is expected that the cost of the case is neutralized by a proportional reduction of the cost of travel (cheaper travel cost without suitcase). This can be achieved in several different ways:

### I **B → C**

Actual reduction of the travel cost and the traveller pays separately for the cost of the Case services

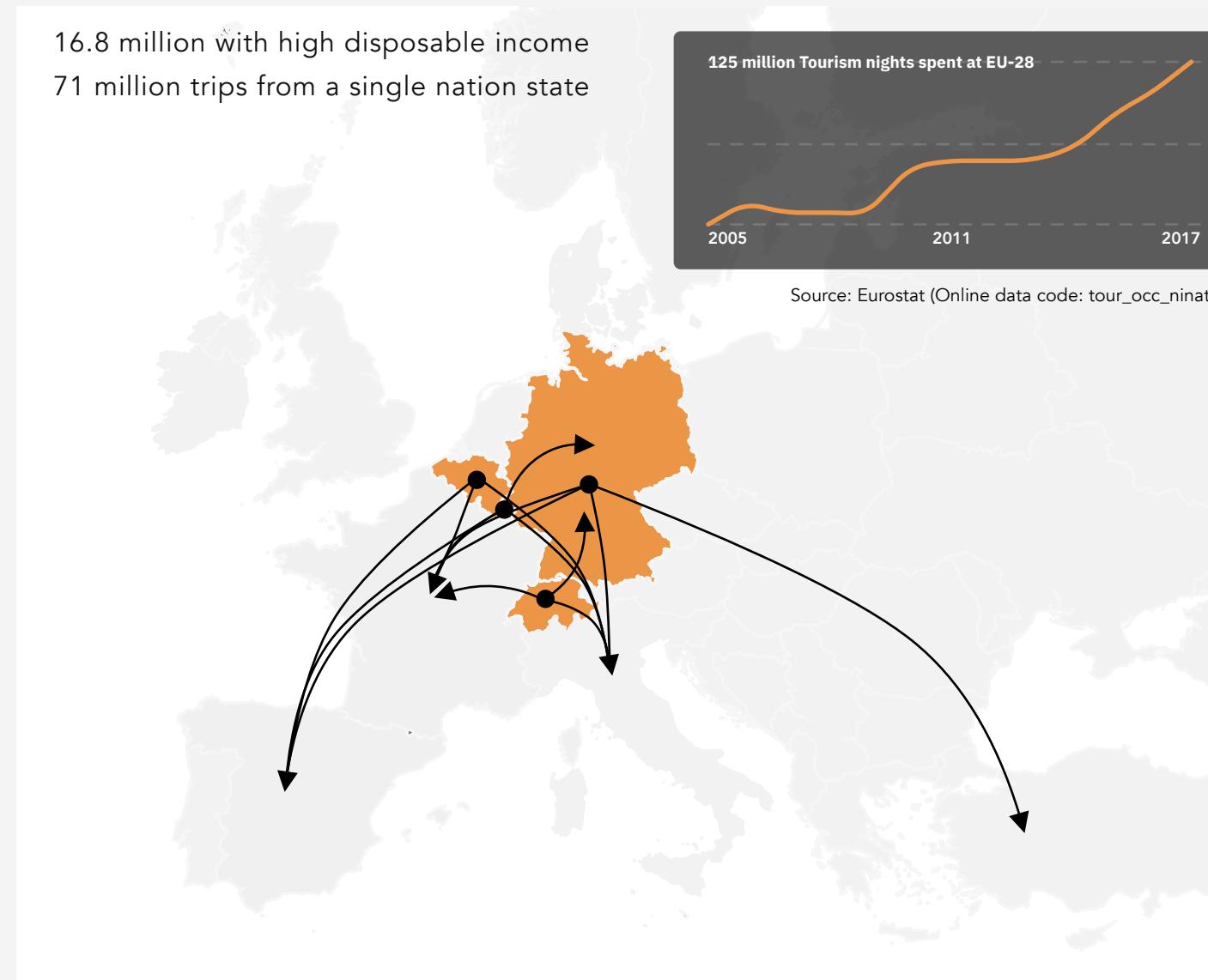
### I **B → B**

Cost of the Case service included in the travel ticket. The transportation companies manage the transition.

Given the innovation embedded in the Case and the potential for significant economic impact on the travel industry, we expect strategic investors (Like: Uber, Airbus, Lyft, Eurostar, Cathay Pacific etc...) to take interest in the idea and to make strategic investment to kick start the service.

# Target Market

(!) Note: This page is from Semester 1



As a market, the European Union will be the initial area of focus for this project. Due to its legislation on freedom of movement of goods and people, it is an easier market to enter with zero boundaries when travelling.

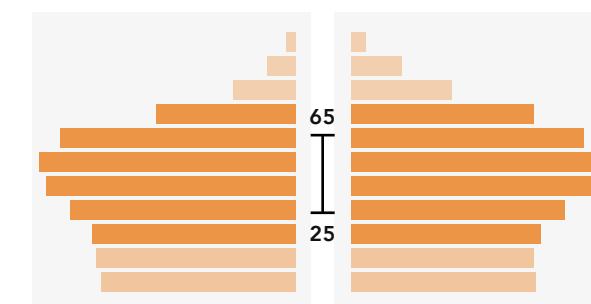
In addition to the above, the European Union consists of well connected routes for freight and logistics. Leveraging ground capabilities would be much more cost and time efficient resulting in greater feasibility at the start of the project.



Average price per mile per container: £0.0061 (Road freight)

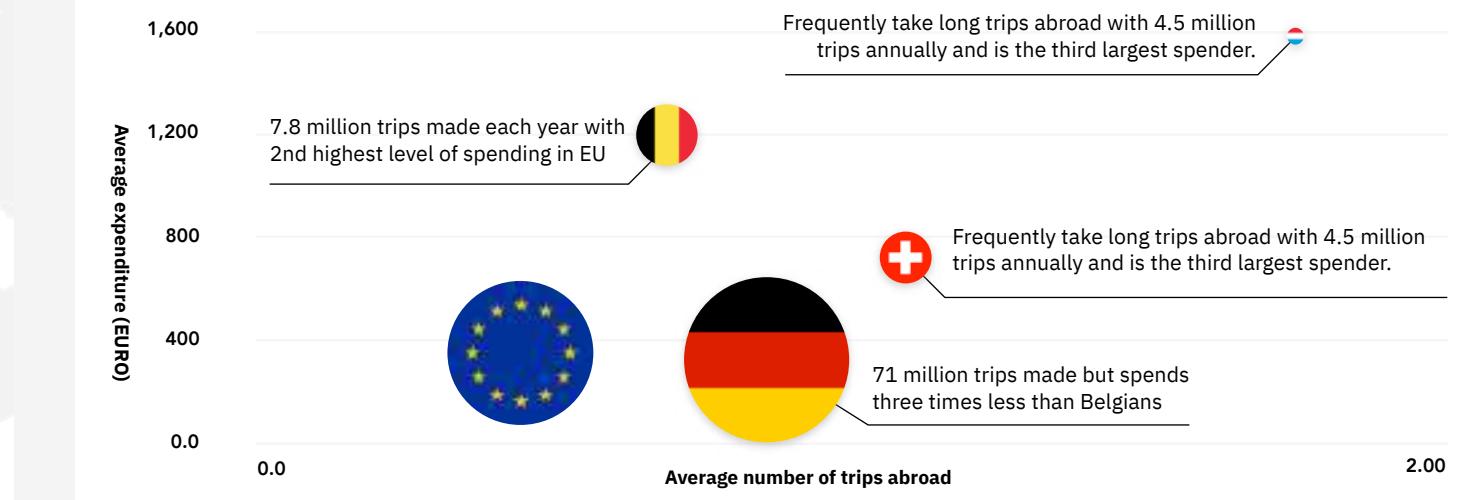
*Calculations may be found in the appendices*

Male



Female

The four chosen countries have very similar population pyramids. This indicates that in about 10 years time, there will be a significantly larger elderly population in comparison to the youth. This project could initially target the adoptive youth, but the main users will be the retired populations with available disposable income.



Source: Eurostat (Online data code: tour\_occ\_ninat)

# Personas

## Early Adopters



**Hugo Martin**

Belgian  
Works @ European Comission  
Medium-High Income  
Travels 4 Business & Holiday  
Family of 3

Individuals like Hugo would be initially targeted upon the launch of Case. Hugo travels a lot and would immediately see the value of travelling without luggage.

Hugo typically travels to the same destinations making it easy to trial the service. His increased income will be able to support the higher “launching price” of Case.

## Growth



**Merle Neumann**

German  
Works @ Spotify  
Medium Income  
Travels 4 Holiday  
Single

Merle is a young professional part of a growing demographic reliant on the shared economy. She doesn't own a car and travels with public transport.

Merle is always keen on trying out new things, and happy to pay that little extra for an enhanced experience.

## Mass Adoption



**The Edwards**

Australian  
Works @ Quantas  
Medium Income  
Travels 4 Holiday  
Family of 5

The Edwards family live in Sydney and every year, they join their father on a vacation abroad. They typically go on family cruises where they are able to spend quality time under the peaceful sun.

The Edwards always look out for the best deal when going on holiday, but don't compromise on a nice restaurant and room.

# Branding

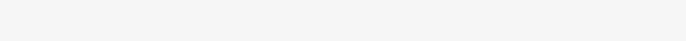
SEMESTER 2

A clear and easily interpreted brand name was needed that could communicate the proposal in a straightforward and familiar way.

It was decided that “CASE” was the most appropriate name for this project. As the product itself is simply a ‘Case’ for travelling. Its simplicity also evokes a sense of standard in its proposal “I’m going to book a case” ensuring that the design of the case may be universally understood and familiar.

Case also stands for a secondary meaning of “a case for the future of travel” which lends itself well to the conceptual nature of the proposal, whilst also highlighting its futuristic and grounded idea.

Inspiration was also taken from existing travel companies adopting simplistic language for effective marketing. Booking.com is an example of this. For this reason, a website domain was also purchased (case.travel) to clearly communicate the concept proposal.



## Colours

Bright, Approachable, Inclusive

**case.travel**

a case for the future of travel





## Case

Case is the enabler of the future of travel. A future where the user is detached from the burden of carrying luggage, unlocking valuable infrastructure costing the transport industry dearly.

It leverages the latest technology to deliver the best travel experience, whilst also providing valuable data to logistic services to ensure an efficient and cost-effective delivery.



## Optimised

Case is optimally designed for use in both the logistics industry and the home environment. Its aluminium unibody enables a rigid and impact resistant form whilst also providing flexible stacking combinations.



## The SmartLid

The smart lid is the key differentiator and enabler of this project. Hosting almost all of the tech, it is able to provide a seamless experience for both the user and service providers.

The SmartLid leverages the latest technologies in a responsible and safe manner. It ensures that the belongings of the traveller are securely locked, whilst also clearly communicating key information needed to guarantee a timely shipment to the users destination.

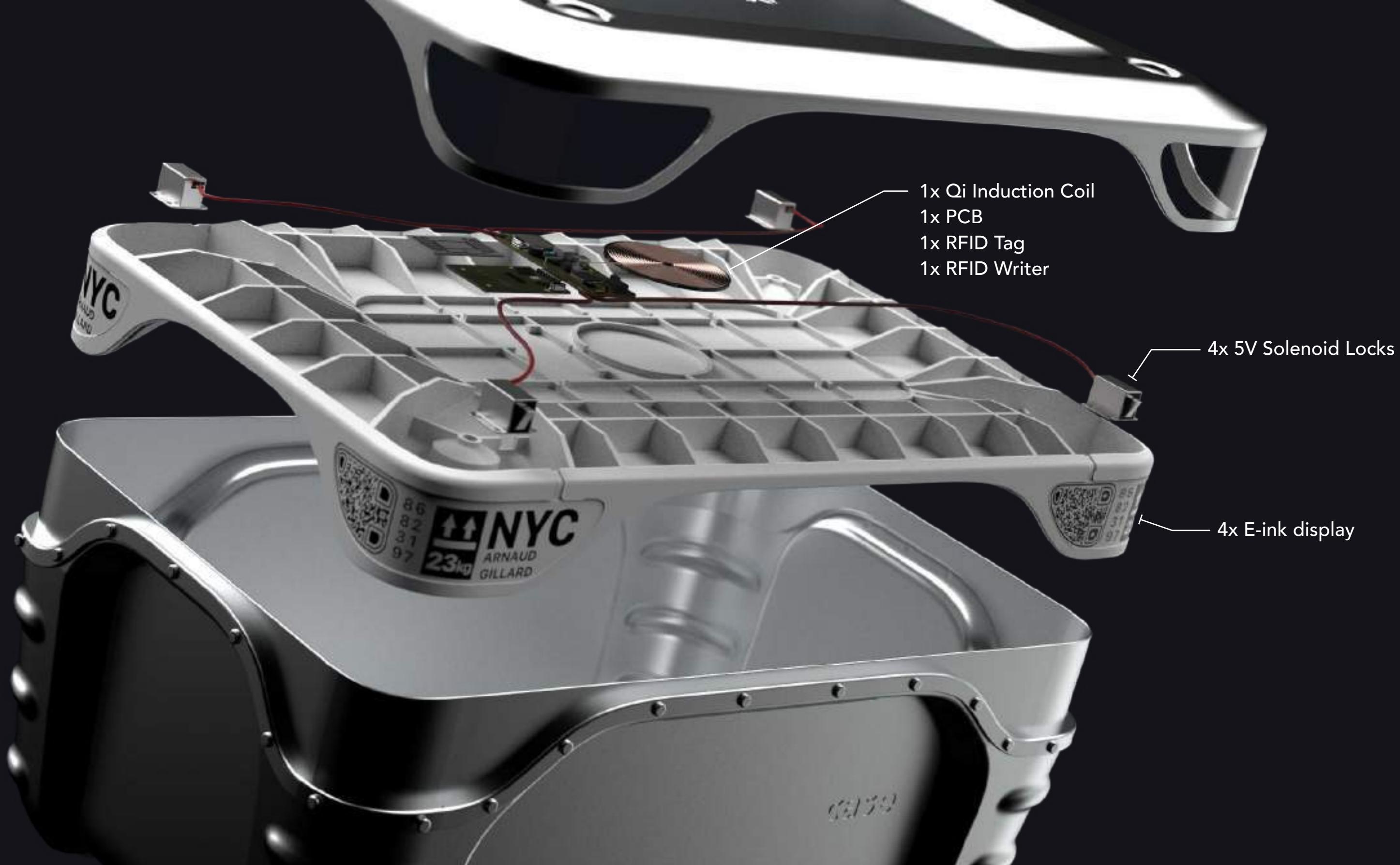
All this without the need for an internal battery.

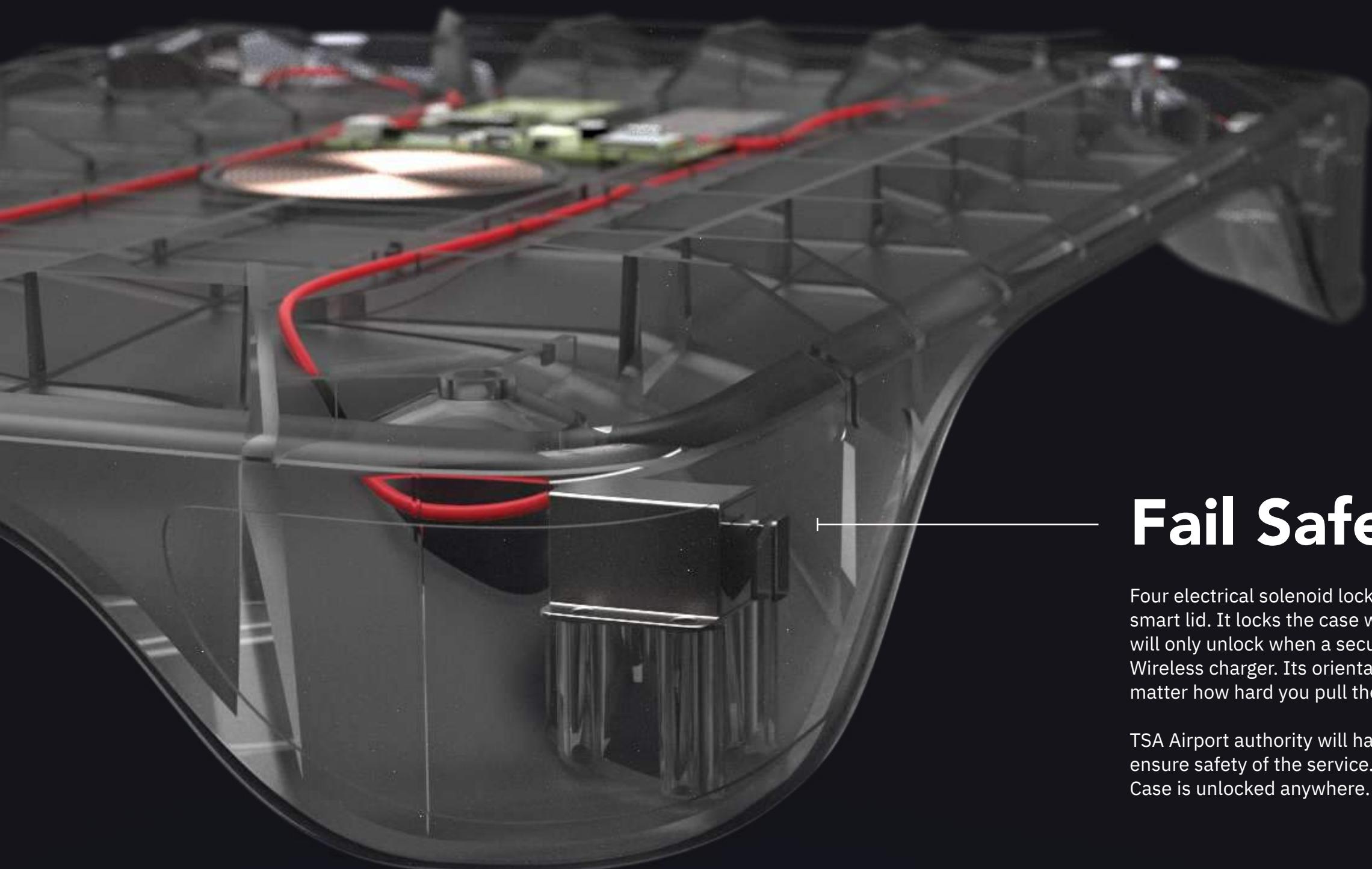


## Induction Power

Case takes advantage of a growing trend of reverse wireless chargers found in smartphones. The power emitted is sufficient enough for the required technologies, simultaneously uploading travel details whilst unlocking the case.

Smartphones also acts as a bridge for internet connectivity by communicating with logistic services, and providing security updates.





## Fail Safe Locks

Four electrical solenoid locks can be found on each corner of the smart lid. It locks the case without the need for any electricity and will only unlock when a secure connection is made with the Qi Wireless charger. Its orientation ensures that it will stay locked no matter how hard you pull the lid.

TSA Airport authority will have certifiable unlocking capabilities to ensure safety of the service. Users will be notified the moment Case is unlocked anywhere.

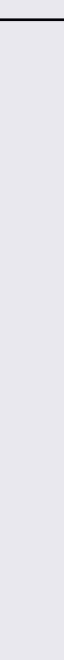


## Digital Scales

Four Load cells are positioned on each corner of the device providing convenient data to users on the weight of their items.

It will only measure its weight when the lid is closed ensuring that no additional items are added / removed when a shipment quote is calculated and paid for.

In addition to this, the center of gravity is also measured and communicated across logistic services. They are then able to pre-book and anticipate the exact case, enabling maximum efficiency of operations.



## Inner Liners

Users will be able to travel using inner liners curated for Case by their favourite brands.

This provides a personal touch to the ‘travel with case’ experience and is able to tailor this to the users preferences.

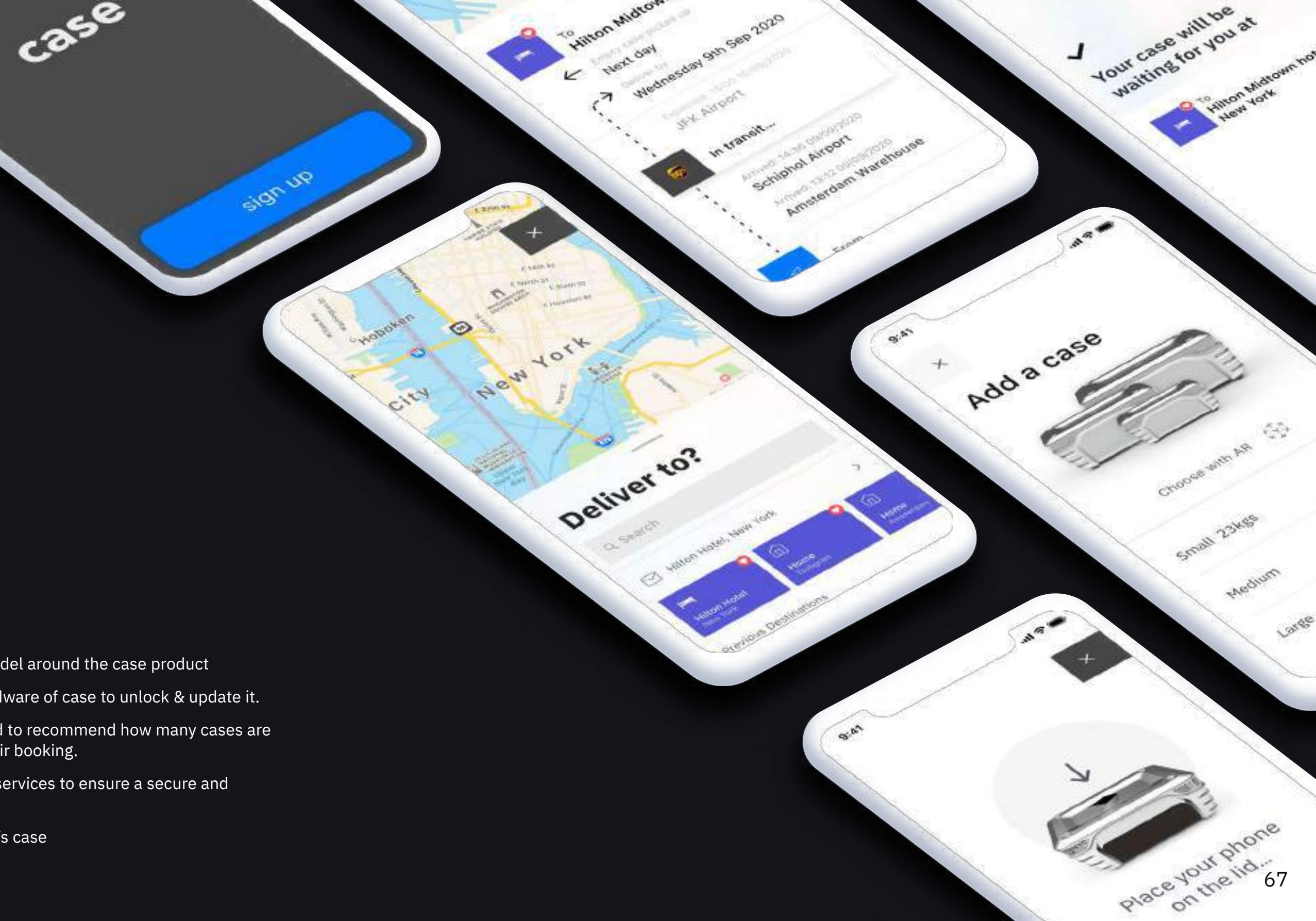
The use of inner liners also helps secure the users belongings in the case, whilst also protecting it’s aluminium surface. It enables users to pack before receiving their case, enabling an efficient process.

# The App

The brains behind the system.

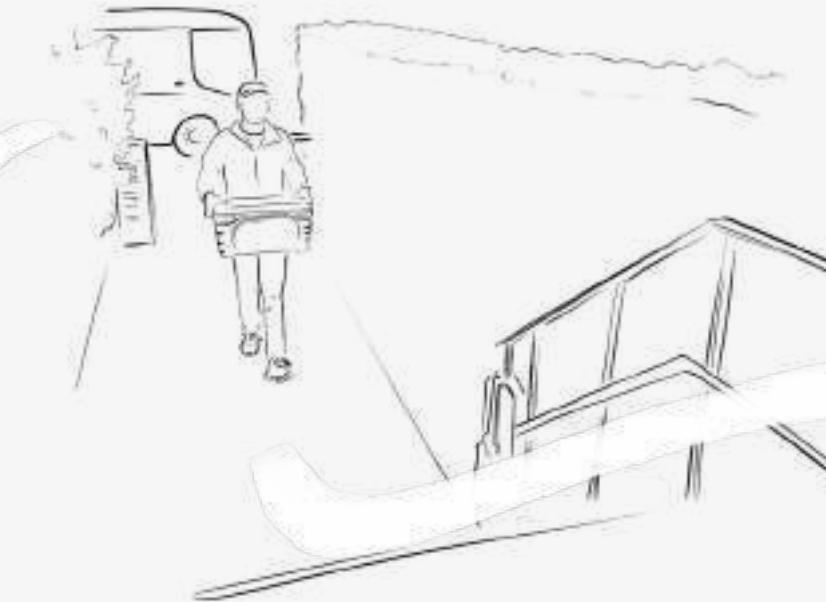
## App functionalities:

- | Enables a shared economy model around the case product
- | Used to interface with the hardware of case to unlock & update it.
- | Augmented reality is leveraged to recommend how many cases are needed before users make their booking.
- | Shares vital data with logistic services to ensure a secure and efficient transit.
- | Monitor the progress of a user's case





A booking is made on the Case app to New York



The Case is then delivered to the users home at the desired time.



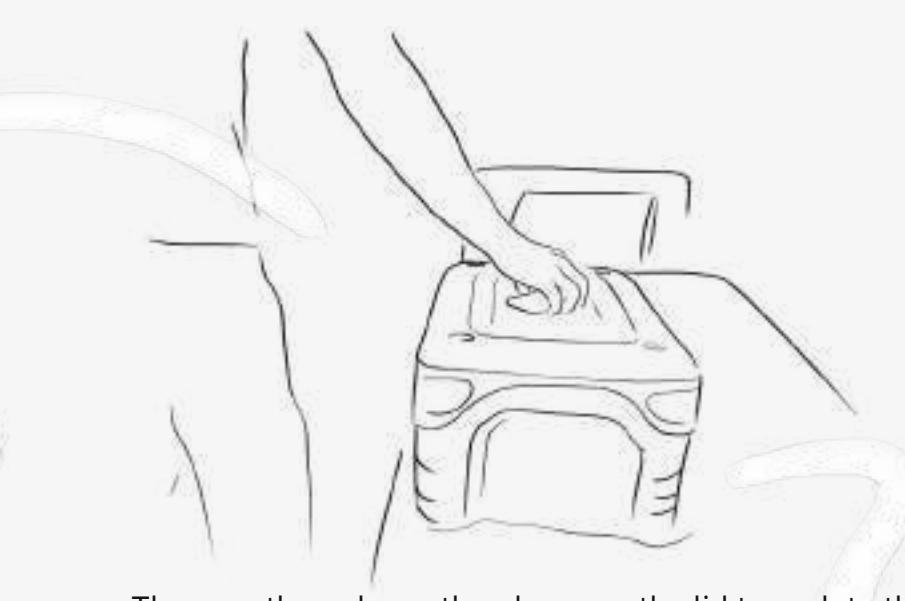
The empty case is then dropped at the travellers convenience.



The user unlocks the empty case using the app.



And packs it with their travel items using their inner lining.



The user then places the phone on the lid to update the Case's RFID tag and E-ink display. It's weight is also measured and communicated to logistic services.



The service then picks up the filled case and ships it to its destination ahead of the traveller.



# Conclusion

Word count: 5,516

This project has been a highly valuable and insightful experience which pushed me out of my comfort zone due to its sheer volume as a project, but also the various domains and skills it required.

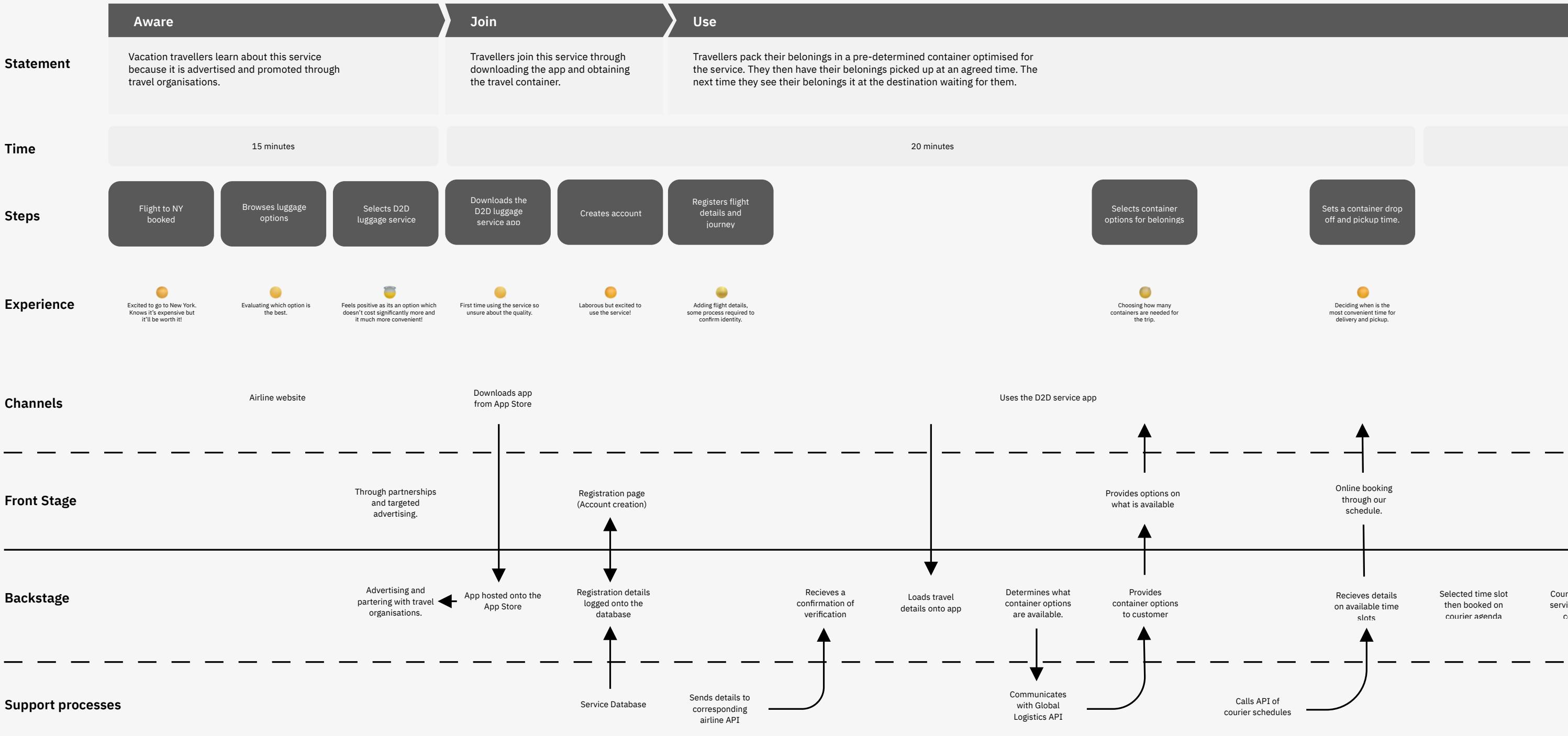
The journey towards the development of Case was challenging, yet rewarding as many unique concept directions were considered and tested throughout the year. Although it must be admitted that tackling a product category such as luggage (which has been optimised for decades) was not easy.

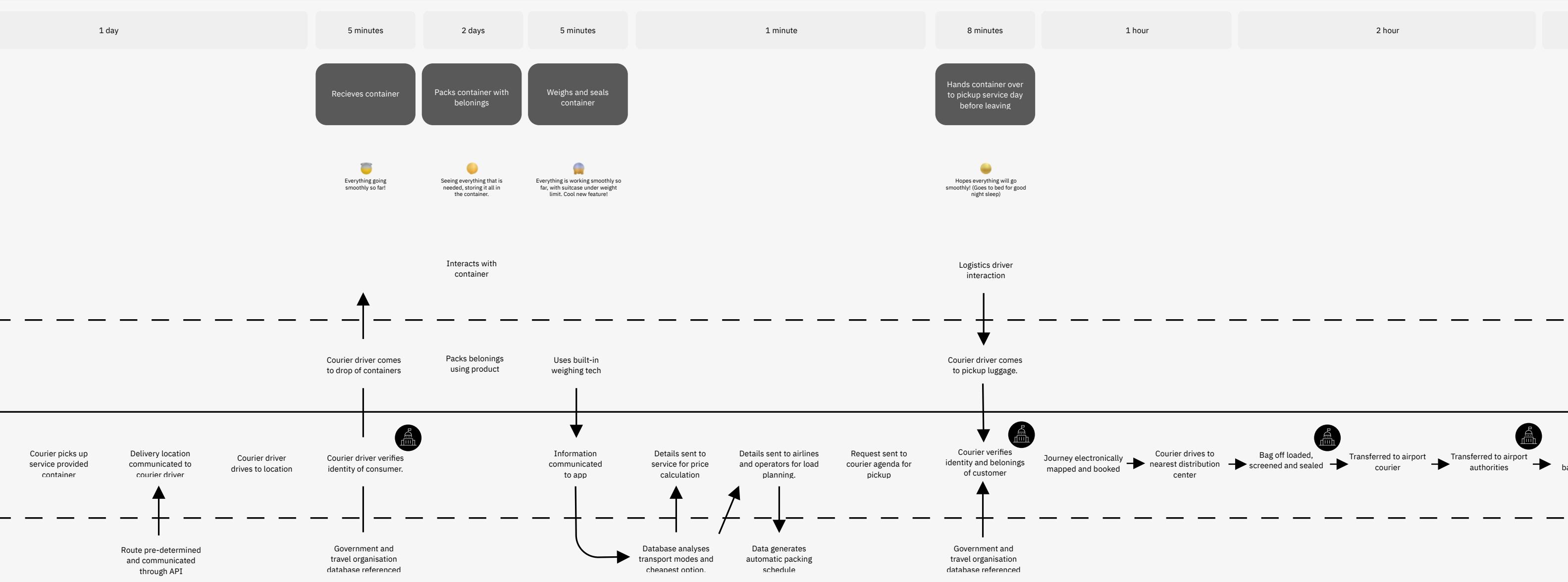
But through identifying consumer and market needs, a unique proposal was generated which I am proud to have created. Although it's purpose in some sense is the same as luggage, its intended environment and function is totally different. Enabling a unique opportunity to re-consider the design of luggage, for the future of travel.

In light of the project outcome, there are several flaws in the project which should be revised. Approaching the logistics industry with a "standardised" case (Similar to containers in the shipping industry) has never really been achieved, and therefore there aren't any concrete proven benefits to this. It has only been estimated. It would therefore be vital to conduct simulations with stakeholders in the logistics industry to understand the true benefits of such a standardised approach.

Overall, I believe that this project has a compelling case behind it. Both the economic forces, and user needs previously identified highlight this. The project will be looking at opportunities to take this idea forward, and with it, continued iterations and development of the product.

# FYDP Service Blueprint





## Develop

When consumers travel next time, they've already had experience with this service. They feel more confident in plan accordingly, without worrying about their belongings during the trip.

1 hour

6 hours

2 hours

20 minutes

Arrives at destination  
with belongings  
waiting for them.

Unlocks container  
with belongings

Uses container as  
temporary storage

Pleasant experience  
arriving with your belongings  
at your destination.

Everything is there as it  
was, securley.

Everything is there as it  
was, securley.

Sees container (How  
do they know its  
theirs at first sight?)

Uses phone to  
unlock container

Uses container as  
storage for belongings

Onlocks container  
using app

Container used as  
temporaty storage



Moved to airport  
priorities

Loaded onto  
baggage system

Sent to pre arranged  
pallets / ULD

Brought to aircraft

Loaded onto Aircraft

Offloaded from  
aircraft



Processed to  
courier van

Courier van arrives  
at hotel destination

Container transfers  
ownership to  
hotel / customer

Identity of recipient  
processed and  
confirmed

## Develop

## Leave

When consumers travel next time, they've already had experience with this service. They feel more confident in their ability to travel and can plan accordingly, without worrying about their belongings during the trip.

Travellers evaluate their experience to allow the service to improve. They come back the next time then travel.

2 hours

20 minutes

- Arrives at destination with belongings waiting for them.
- Unlocks container with belongings
- Uses container as temporary storage

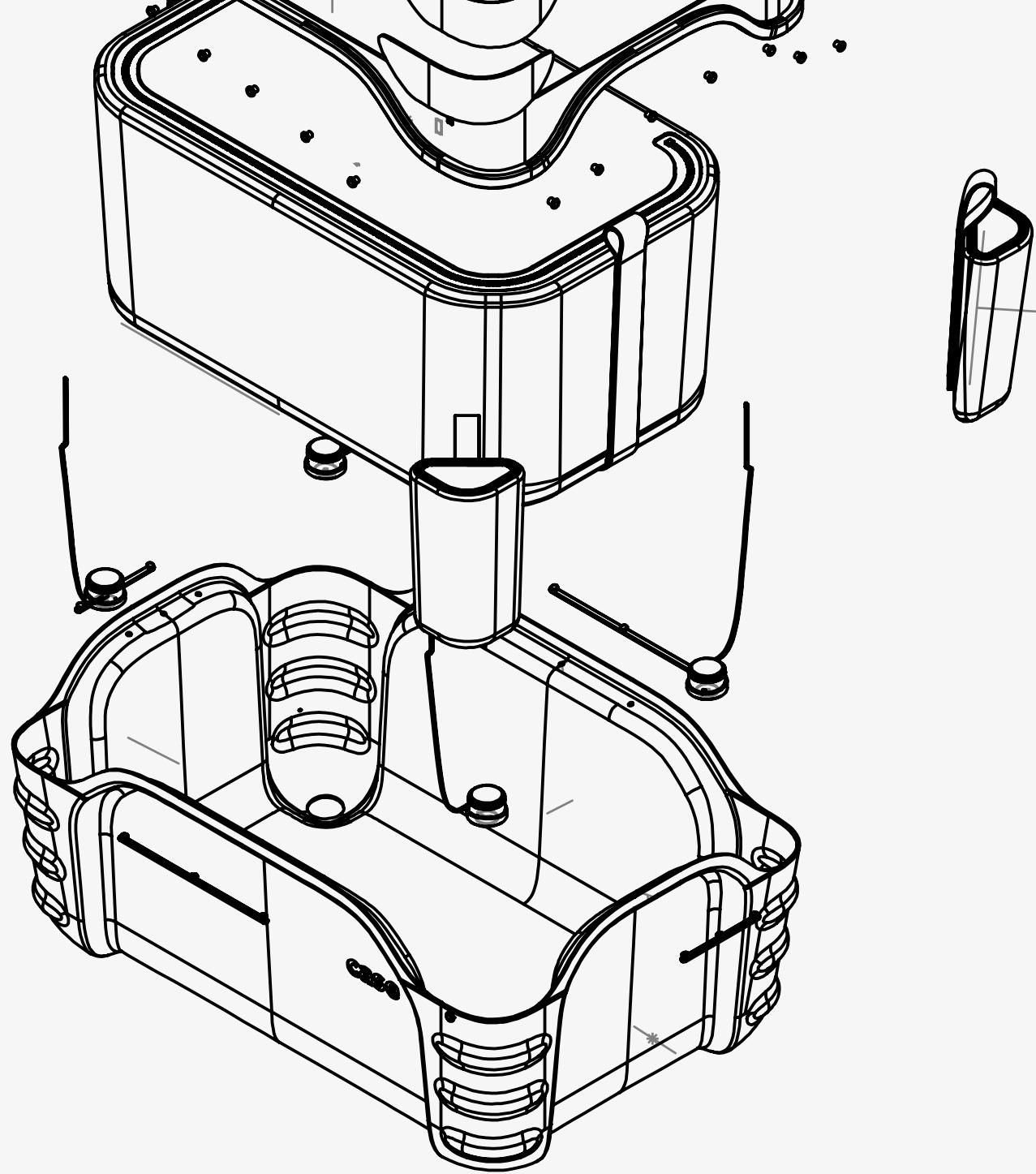
Pleasant experience arriving with your belongings at your destination.

Everything is there as it was, securely.

Everything is there as it was, securely.

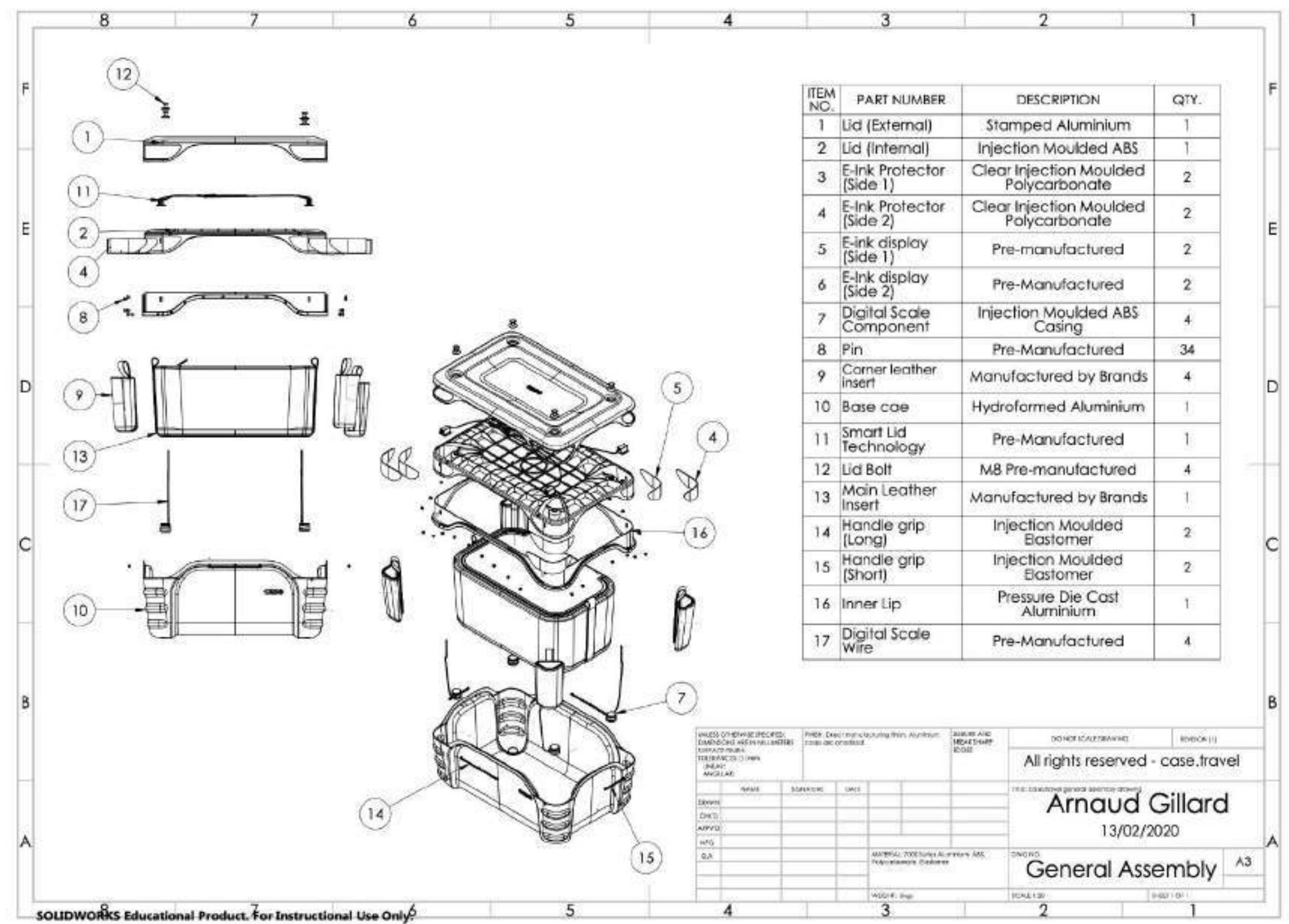
- Sees container (How do they know its theirs at first sight?) →
  - Uses phone to unlock container
  - Uses container as storage for belongings
- Onlocks container using app
- Container used as temporary storage

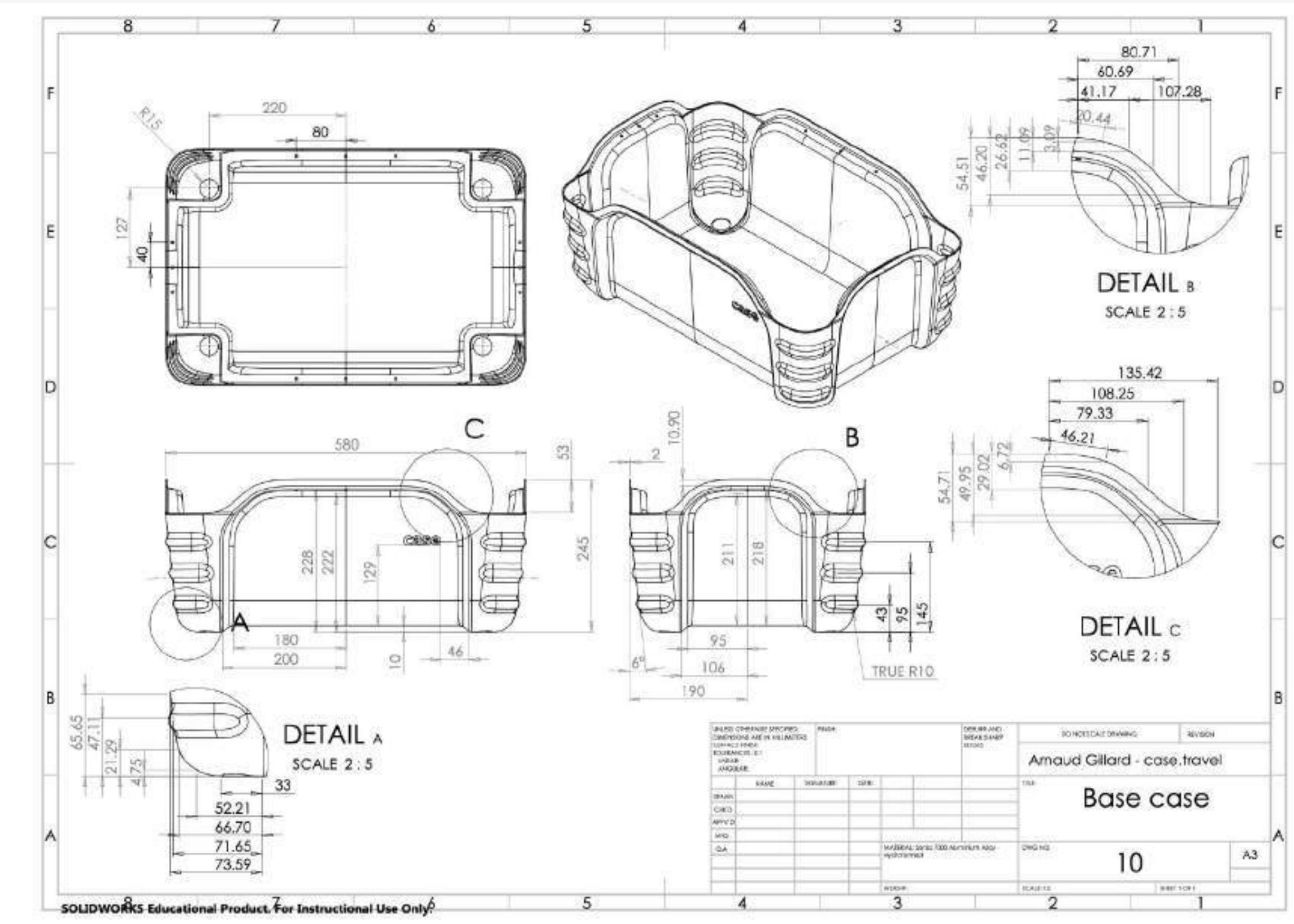
- om → Processed to courier van → Courier van arrives at hotel destination → Container transfers ownership to hotel / customer
- Identity of recipient processed and confirmed

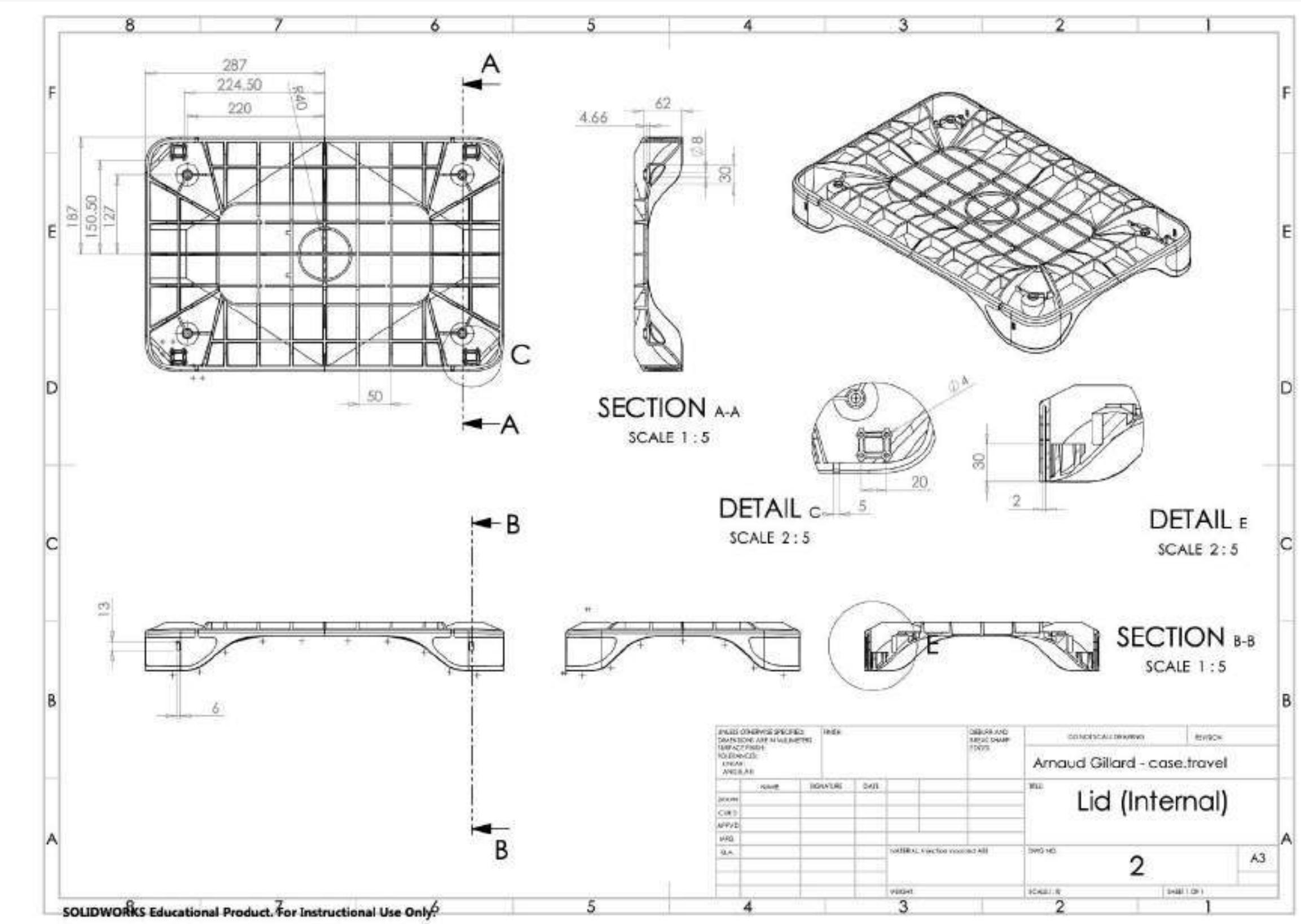


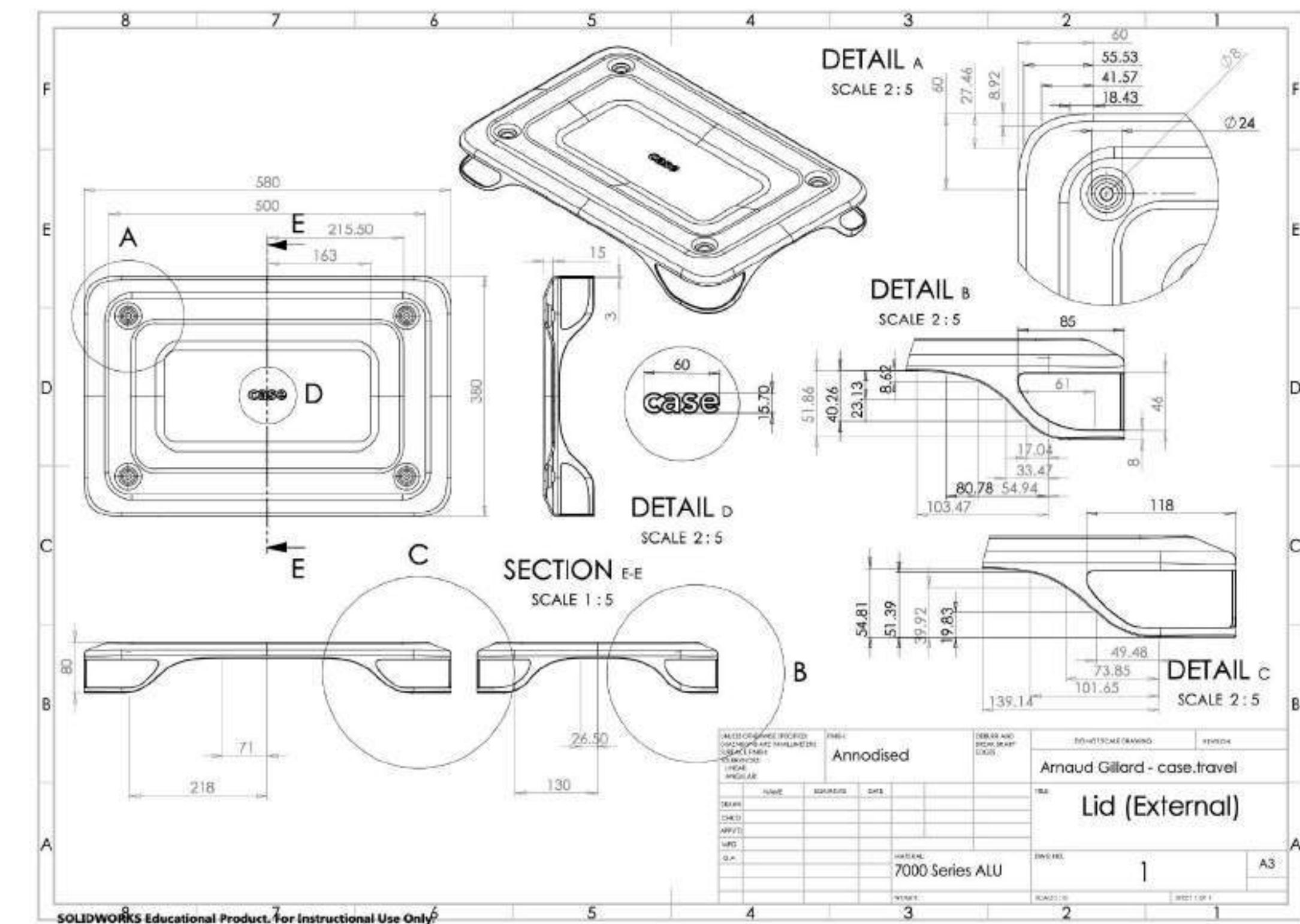
PDF Copies may be found in the  
“Design resources folder”

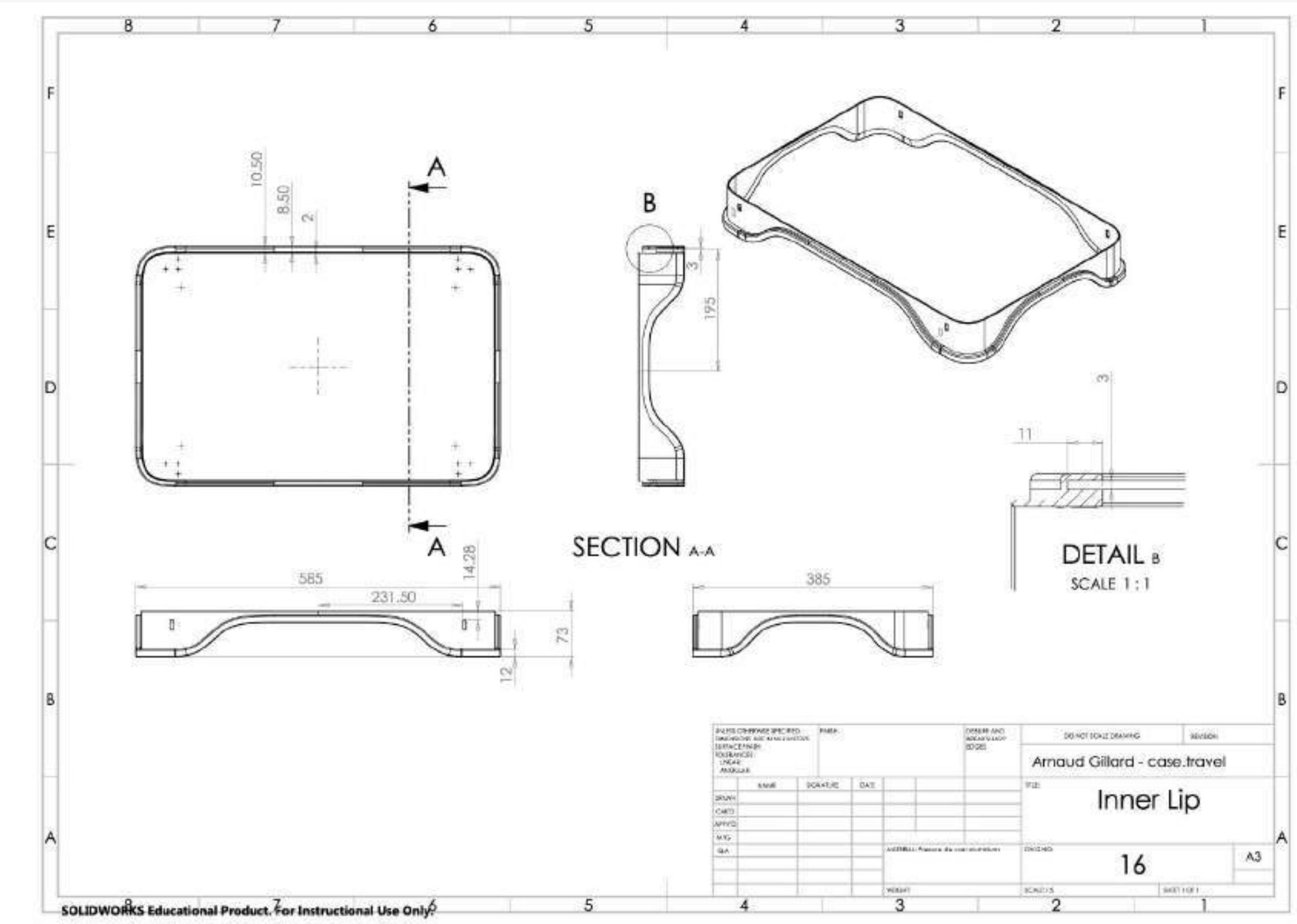
# Engineering Drawings





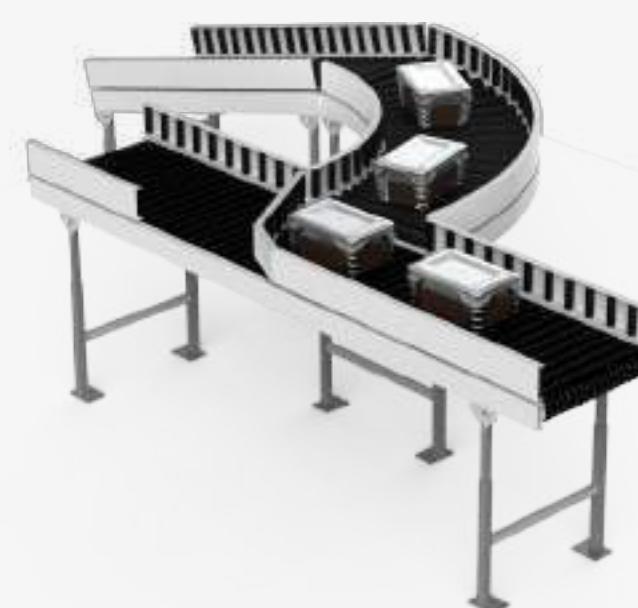
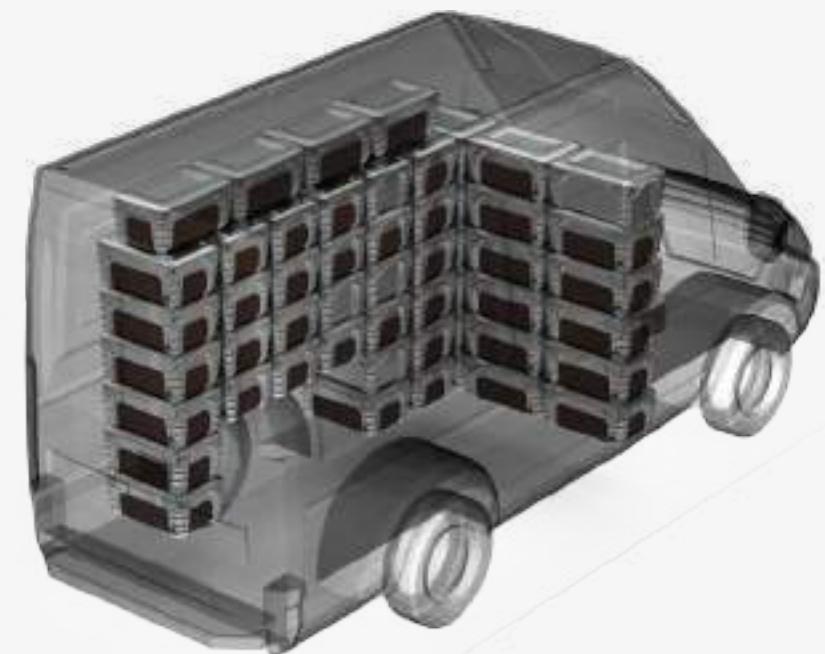






# Product Design Specification





# Pricing - Product

Component Details							$M_c = V \times C_{\text{rel}}$			$R_c = C_c \times C_{\text{exp}} \times C_s \times [C_d]$													
Part No.	Part Description	Material	Process	Production quantity per annum	Shape Complexity	Volume of part (V)	Material cost per unit volume ( $C_{\text{rel}}$ )	Waste Coefficient ( $W_c$ )	Material cost ( $M_c$ )	Basic processing cost ( $P_c$ )	$C_c$	$C_{\text{exp}}$	Section [mm]	$C_s$	Tolerance (mm)	$C_t$	Surface finish ( $\mu\text{m}$ )	$R_a$	$C_r$	$C_b$	$R_c$	$P_c \times R_c$	$M_i$
1	Main Container	Aluminium	Hydroforming - Sheet Metal forming	20,000	C4	1123106.54	0.00083	1.5	1398.267642	4	2.1	1	2	2	0.1	1	0.7	2	2	4.9	19.53	1417.797642	
2	External Lid	Aluminium	Sheet Metal Forming	20,000	C4	767986.7	0.00083	1.5	956.1434415	4	2.1	1	2	2	0.1	1	0.7	2	2	4.9	19.53	975.6734415	
3	Internal Lid	ABS	Injection Moulding	20,000	B4	1333942.23	0.000353842	1.1	519.2055733	5	1.9	1	3	1	0.1	1	0.5	1	1	1.9	9.5	528.7055733	
4	Scale Component	ABS	Injection Moulding	20,000	B3	5546.7	0.000353842	1.1	2.158922245	5	1.7	1	3	1	0.1	1	0.5	1	1	1.7	8.5	10.65892224	
5	Lid lip	Aluminium	Die Cast	20,000	B4	287136.84	0.00083	1.2	285.9882926	6	2.3	1.5	3	2	0.1	1	1	1	1	5.2	31.05	317.0982926	
6	Handle Grip 1 (long)	Rubber	Injection Moulding	20,000	B1	2507.17	0.00018	1.1	0.49641966	6	1	1	3	2	0.1	1	0.5	1	1	2.1	12.6	13.09641966	
7	Handle Grip 1 (Short)	Rubber	Injection Moulding	20,000	B1	1377.59	0.00018	1.1	0.27276282	6	1	1	3	2	0.1	1	0.5	1	1	2.1	12.6	12.87276282	
8	Handle Grip 2 (long)	Rubber	Injection Moulding	20,000	B1	2507.17	0.00018	1.1	0.49641966	6	1	1	3	2	0.1	1	0.5	1	1	2.1	12.6	13.09641966	
9	Handle Grip 2 (Short)	Rubber	Injection Moulding	20,000	B1	1377.59	0.00018	1.1	0.27276282	6	1	1	3	2	0.1	1	0.5	1	1	2.1	12.6	12.87276282	
10	Scale 2 Component	ABS	Injection Moulding	20,000	B3	5546.7	0.000353842	1.1	2.158922245	5	1.7	1	3	1	0.1	1	0.5	1	1	1.7	8.5	10.65892224	
11	Scale 3 Component	ABS	Injection Moulding	20,000	B3	5546.7	0.000353842	1.1	2.158922245	5	1.7	1	3	1	0.1	1	0.5	1	1	1.7	8.5	10.65892224	
12	Scale 4 Component	ABS	Injection Moulding	20,000	B3	5546.7	0.000353842	1.1	2.158922245	5	1.7	1	3	1	0.1	1	0.5	1	1	1.7	8.5	10.65892224	
13									0										0	0	0	0	
																					3333.79		
																					Cost in € 33.33789004		
Existing component USD / Pie How many needed?				Total price for product			Assembly cost: Cost in USD How many times Total cost:														Total 49.3079		
Load cell	0.8			4	3.2				Rivet	0.0234	16	0.3744											
E-ink display	1			4	4				Scale sub assembly	0.0126	4	0.0504											
Qi Induction Coil	0.6			1	0.6				Scale assembly	0.018	4	0.072											
RFID Tag	0.15			1	0.15				Lid electronics assy	0.1	1	0.1											
Solenoid Lock	1.68			4	6.72				Lid assembly	0.018	1	0.018											
PCB	2			1	2				Magnets	0.0126	2	0.0252											
Round head Rivet	0.05			16	0.8				Total:	0.64													
Rubber grip soles	0.04			4	0.16				USD-Pound:	0.52													
M8 Hex Screw Bolt	0.35			4	1.4																		
Total of standard components:				19.03																			
Convert USD - Pounds:				15.45																			

# Market analysis calculations

## ELECTRONIC ARRANGEMENTS

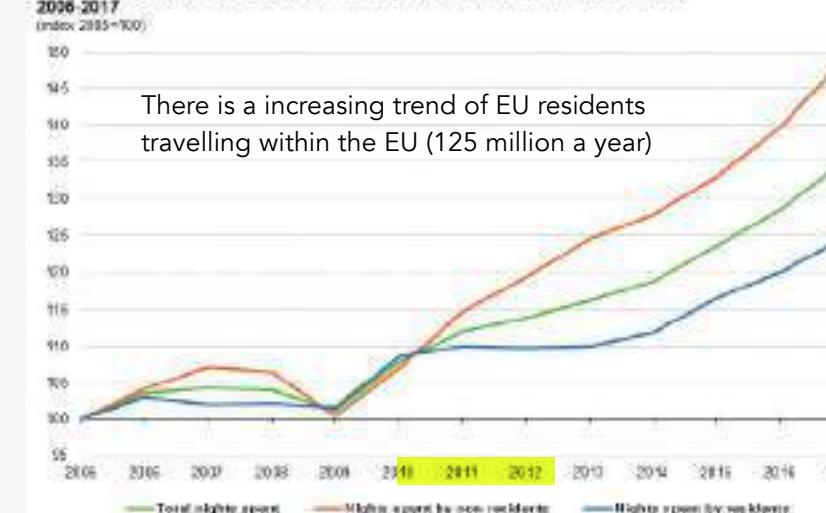
### Trips around Europe

"In 2017, Spain was the most common outbound tourism destination in the EU for people travelling outside their country, with 306 million nights spent in tourist accommodation, or 20 % of the EU total."

"62 % of EU residents made at least one personal trip in 2017."

Tourism\_statistics#Tourism\_expenditure:\_highest\_spending\_b  
y\_German\_residents [Accessed 11 Dec. 2019].

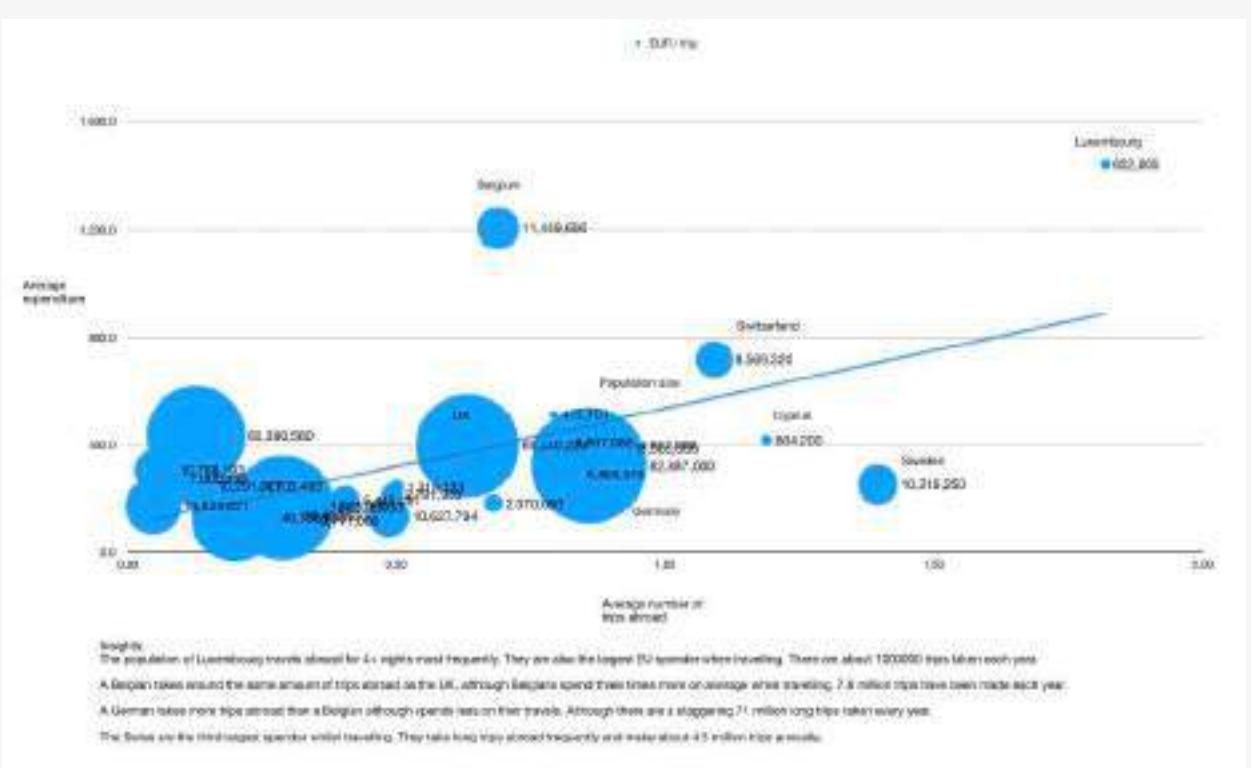
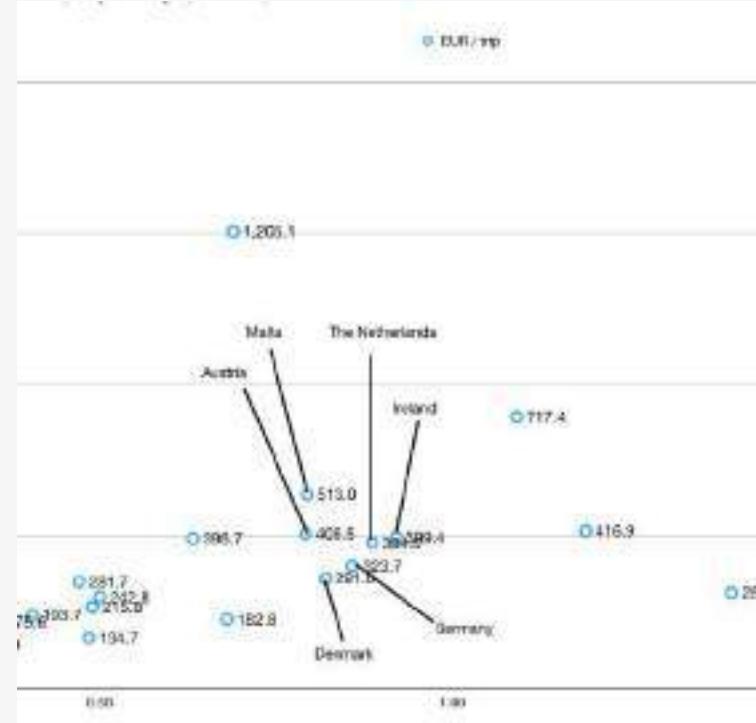
Trends in nights spent at EU-28 tourist accommodation establishments, EU-28, 2006-2017



Note: EU-28 aggregate estimates for the purpose of this publication, using the best available data for the EU Member States. Because of methodological issues inherent to some Member States' data from 2012 onwards, some are not fully comparable with previous years due to affected the estimation of the EU-28 aggregate.

source: eurostat (online data, 12.08.1917\_100\_0000)

eurostat



Country	Number of trips abroad (millions)	Number of short stay tourists abroad	Number of long stay tourists abroad	Average expenditure (EUR/trip)	Number of tourists who spend most on a trip			
					EU-28 avg.	Population size	Average no. trips per person	Average no. trips abroad per person
Belgium	15,281.909	12,986.448	2,295.459	8,130.560	1,206.1	11,418,666	1.36	0.09
Belarus	6,481.000	597.652	551.354	1,495,000.000	273.4	1,888,609	0.39	0.06
Croatia	38,815.000	1,610.071	3,961.929	4,967,000.000	124.7	10,817,704	5.37	0.35
Denmark	28,779.000	3,279.348	4,284.785	8,086,000.000	281.0	5,888,213	0.51	0.02
Germany	243,527.000	21,911.189	7,104.489	10,239,000.000	273.7	80,887,000	3.04	0.36
Estonia	4,550.000	975.085	600.023	1,185,000.000	242.6	1,238,152	2.46	0.09
Iceland	14,553.000	2,578.188	4,465.352	5,294,000.000	298.4	4,827,000	5.39	0.32
Ireland	6,219.000	91.449	106.960	1,985,000.000	266.6	13,739,199	0.46	0.01
Spain	187,788.000	15,338.384	8,311.198	9,759,000.000	278.7	49,739,008	5.27	0.11
Poland	330,777.000	8,621.098	18,625.253	34,870,000.000	288.1	87,372,000	3.28	0.12
Croatia	4,383.000	288.048	806.169	1,287,000.000	249.1	4,738,499	1.13	0.02
Albania	86,407.000	3,887.365	7,033.238	24,457,000.000	402.0	10,389,390	0.06	0.12
Cyprus	2,794.000	327.665	187.255	1,497,000.000	476.5	864,000	5.74	0.44
Lithuania	4,094.000	194.912	841.868	1,985,000.000	244.6	4,497,400	0.11	0.01
Luxembourg	2,480.000	388.785	1,086.000	1,086,000.000	278.0	219,400	1.05	0.09
Portugal	18,888.000	1,388.039	2,307.009	11,177,000.000	177.0	16,771,000	1.09	0.02
Malta	897.000	195.000	371.078	24,900,000.000	273.0	479,708	1.79	0.19
Netherlands	44,904.000	1,621.758	18,336.104	17,280,000.000	184.5	17,306,000	2.09	0.09
Austria	33,080.000	4,748.448	7,611.846	9,494,000.000	198.5	9,867,000	0.39	0.01
Poland	87,873.000	3,272.313	8,886.390	18,180,000.000	288.0	36,423,000	1.41	0.12
Portugal	11,071.000	698.039	1,276.082	12,260,000.000	298.7	12,267,007	1.75	0.12
Romania	11,880.000	1,022.188	803.860	3,228,000.000	171.8	19,623,001	2.06	0.08
Slovenia	4,452.000	1,691.000	1,460.268	862,000.000	288.5	2,283,000	2.09	0.08
Bosnia	10,934.000	1,601.146	2,084.810	11,750,000.000	193.7	5,544,007	2.09	0.01
Sweden	32,940.000	9,778.018	14,255.873	16,180,000.000	333.0	10,293,259	5.8	0.10
United Kingdom	86,071.000	13,021.320	3,229,048	10,200,000.000	284.7	66,813,229	2.05	0.02
Bulgaria	32,094.000	4,070.182	8,246.148	14,210,000.000	229.4	4,888,332	2.08	0.03
Total	1,285,210,000	349,078,069	340,275,000	1,285,210,000	281.7	215,400,894	2.49	0.07