

Metropolitan Parcel Distribution

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Submitted in partial fulfillment of the requirements for the degree of

Bachelor of Industrial Design

Humber College

School of Applied Technology

April 202



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Signature : Student Name : Evan Demczuk**Abstract**

The delivery industry has been the backbone of industries all over the world, and significantly increased with the advent of digital commerce. Many companies continue to use transports that rely on manual labor that is becoming progressively intensive which has put strain on these systems. To assist the parcel handlers and accelerate company commerce, this thesis project was developed as a solution to the urban transportation of parcels. User and industry studies inform ergonomic workflows, alternative methods of delivery, organization, security and awareness. The culmination of these factors has led to the design of a compact transportation vehicle capable of deploying curbside vending machine equipment and other cargo packages to reduce manual labour and save resources including time. Ergonomics focused on a concept canopy with a standing-leaning drivers' seat. The application of autonomous operation was also explored in an industry exploring its potential. The harmony of these elements created a user-centered delivery system to benefit a large connection of users.

Acknowledgements

A major thanks goes out to the following people and groups for assisting me in completing this project and getting my degree.

Dennis Kappen & Bachelor of Industrial Design Faculty

For being there for anything I needed and guiding me through this course with the best of their knowledge.

Agile Printing

For helping produce seamless 3D prints for the final model at a great price as well as speedily through a pandemic.

My Family

It's been an extremely eventful year for my family but they had my back all the way through. I could thank them in endless ways.

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CHAPTER 1

This first chapter will look at the problem being the base of design for this thesis project. It will acknowledge the overarching demographics and why there is a problem that requires solving by product design as well as the general approach to research methods.

1.1 Problem Definition

The goal of this thesis is to develop a more fluid workflow and user focused experience for the delivery of parcels in this high-demand industry. This stemmed from the following;

“Last mile logistics” is a topic that involves the movement of goods between warehouses and their final destination. It encompasses a large variety of reasons and products that are being moved, and uses a wide range of products to complete the task.

The largest demand in this umbrella lies on the shoulders of the parcel delivery business, trying to move single or few artifacts to a very specific location. A massive industry, led by companies such as UPS in the Americas, delivers a staggering 19 million+ artifacts every day. Every last product is delivered by a chain of people and tools. It’s well known that achieving this requires extreme efficiency; which puts pressure on delivery personnel from the companies involved and the people receiving their product. The care of these artifacts is crucial and are put foremost, ahead of the personnel tasked with the job. Here lies the opportunity for improving the lives of millions of workers, among company organizers and consumers.

Many of the products available today are built with the focus on efficiency with baseline consideration for the user. There appears to be an opportunity to improve the workflow of the user to create better efficiency among current tactics already used. Research into the field will uncover specifics.

Urban environments have complex terrain that are clashing together to make it difficult for anything except point to point delivery. It’s in this environment that presents the most issues for the delivery personnel and the lowest opportunity for drone technology to take over the human aspect.

To summarize what the problem is, it’s best to ask a question:

How may we improve the ability for last mile logistics to function in high-density environments?

1.2 Investigational Approach

In order to develop a product that is credible, finding relevant information in the field of parcel delivery will be essential to a successful product. In order to better understand the user and current practices in the industry, using a wide variety of research methods will be required, including but not limited to:

- Literature review
- Product Benchmarking
- User observations
- Vlog analysis
- User Activity mapping
- User surveys
- Ergonomic considerations
- Sustainability considerations
- Interviews with experienced transportation designers
- Interviews with parcel deliverers

All of the collected information will then be discerned and organized to find relevant elements to include in the considerations for product design. The problem definition has created an understanding of what is required by the project. As a goal, the following subjects will want to be answered by the researched material.

Security - For people and packages alike; they are other people's property!

Ergonomics & Workflow - How can I make it easier to overcome those last mile obstacles and assist the full-body motions?

Technology - Drones and automation are a hot topic, and how will they work with humans?

Mentalities- Can we encourage better mental health through comfort and ease of use?

Environment - Can I make a product that doesn't clash with the urban environment? Can I make it sustainable?

Industry Standards – Will the result be able to compete with current methods being used.

Keywords in searching are focused on "last mile delivery", parcel, transportation, urban environment, and autonomous technology. It is also important to prove the need for human interaction in this field, which is being overshadowed by the developing drone industry.

1.3 Social Context

History of use

In history there has always been a need to move products. Originating from ancient times of animal harnesses to modern day transport trucks. One of the first major methods of transport was the engineering of ships to carry items down river. The Industrial Revolution saw a much greater need to transport supplies to factories and more, which brought trains to towns and factories. Once motorized transportation was possible, early cars were upfitted to carry goods and transport became a personal matter. As the Modern Age approached, vehicles became more specialized with transport trucks. Catalogue orders started becoming main place, this was to be succeeded by online shopping, which made to-door delivery of packages a standard practice in today's society, as well as the use of vans to do so.

Lifestyle

It is well known that the online shopping industry is growing at extreme rates. This is one of the major social phenomena of the 21st century. Supporting this massive industry is the logistics and transportation sectors. During certain times of the year, consumers purchase massive amounts of goods that need to be delivered for the occasions, but the industry is just barely making it by, often with large amounts of reception mistakes. This impacts the experience of online shopping. (Wang, 2019)

For the job itself, services are trying to adapt to the fluctuating workloads and people's schedules. Options, such as Amazon Flex, allow for leverage against these demands, but still have issues with cost-efficiency for the tertiary users. The growing social concerns for traffic congestion and pollution are also prominent when putting more people on the roads to compensate for demand, raising concerns among social scientists and environmentalists. Many urban communities are questioning the place of unmanned vehicles in the social environment, as it is relatively untested as of this stage. Most tests today are focus on point to point in certain landscapes, limiting their place in the cities, as well as their ability to help people achieve higher standards of living. (Wang, 2019)

CHAPTER 2

This chapter will look at the results gained from various research methods such as observations, literature searching, interviews and visual studies. This information is crucial in creating human centered design. Through a section focused on the user, and a section focused on benchmarking products, this chapter will outline the needs and benefits required of the people involved and the products they use in the field of parcel delivery.

2.1 Introduction to User Research

In order to design for a thesis project on parcel delivery in urban areas, one must have a plan to research the user for whom they are designing. This will support understanding the capabilities of a person, and what they do. Using strong techniques like creating relationships with users and analyzing their movement and patterns to better understand them engages the foundation for design. Literature reviews are necessary for understanding the broader spectrum of information.

2.1.1 User Profile

Demographics

By the case of observation, as well as statistical data, it is shown that most people operating the delivery industry are between the ages of 20 to 70, averaging 45 with relatively fit physiques due to the constant need of labor. The majority of the population are white Caucasians dominated by the male gender, but still has a considerable female population that also relies on these types of products. (DataUSA 2017). The profession is open to anyone with the right attitude about getting things moved, and doesn't have a high tolerance for people who can't work efficiently.

User Behavior

In the case of vlog videos, it appears that a lot of drivers have a driven attitude that keeps them going, and an interest in being able to drive around and handoff packages. It appears that many users tend to develop their own strategies to combat common problems, like van layout, by using their dashboard to fill with small parcels, and the ways that they organize the contents of their vehicles. Moving packages are often done hastily but rarely to the point of product damaging, but that is not to excuse the cases that do. (Appendix D)

Outside of work, they could have a wide range of hobbies. Generally speaking, parcel deliverers are people with a liking for driving and getting outside to move around. They like to socialize even if the job doesn't actually allow for much conversing with people. The mix of solitude and interaction makes for a peaceful job. They often have families and would like to spend more time with them. (Appendix B)

Primary, Secondary, Tertiary Users

Primary Users

The primary user of study will be the parcel courier themselves; a person who handles parcels in a high capacity company such as UPS or FedEx. While there is a number of divisions that this may include, such as drivers compared to pre-loaders, their job is a part of the process to getting parcels delivered to a customer from a customer. They are labor workers that are skilled in organization, time management, and driving. They are not fiscally responsible for the product at hand, and use it as a tool in the workplace, provided by the tertiary user. It's important to design for this user because they are the pushing force of the companies that buy the product and should be made for accordingly so.

Secondary Users

The receivers are the second most important people in the effect of these products. They are the customers that spend money to get goods delivered from one place to another, and want it to be done in a timely manner. The demographics of this user can range from anyone with access to long-range purchasing, primarily the internet. It could be the business owner expecting a new tool to improve their customer service, or a teenager buying a new pair of earphones off of Amazon.

Tertiary Users

The third tier of user would be the company organizers, with the purchasing power for the product to provide to their employees. While they do not directly use the product, they are trying to improve their bottom line and efficiencies in the system to better their company. They don't always think about the primary user, and are more focused on the technicalities of what the product can do, such as fuel consumption or cost of maintenance.

User Persona

Based on evidence from report 2 in appendix B.

Persona

Name: Christopher Anderson

Age: 52

Job: Federal Postal Worker, 12 years

Education: Business degree

Relationship: Married, 3 daughters

Location: Suburbia New York, delivers in city

Hobby: Coffeeshop socials

Frequency: If he can find time

Works an average 10 hour shifts, currently
6 days a week because it's holiday season

Profile:

Chris is a Caucasian male who went to college for a business degree but couldn't keep up with the changing atmosphere and fell into postal work to pay the bills for his family. He's making \$52,000 a year. He has to help his ailing father which puts on more financial pressure to keep his job, as well as anticipating 2 teenage girls entering university, with one already enrolled.

He enjoys social gatherings and getting to interact with people, so he thought postal work would be ideal for meeting with unique people, but found the job much more demanding than he anticipated. He spends long hours in the postal truck, and suffers from back pain from constant lifting. His family is concerned for his well-being, but he knows it's an honest job and it pays so he keeps at it.

He's gotten very good at his job over the years, and has a high efficiency rate. He gets frustrated when problems in the postal system get pinned on him by customers. His high organization skills and honest respectful personality aren't appreciated enough. He finds that having his father ride along with his deliveries to help both improves his mental health and gets his father out of the house. His truck is showing its years of use and has seen lots of maintenance. He's done his best to understand the vehicle and all its limitations, including storage space. He's had to replace the wheels on the hand truck many times, and could never find a way to hold it comfortably, and it's becoming harder to move as he ages. While he's always exhausted seeing his truck, it's his workhorse and he wants it to be reliable.



Figure 1 Postal worker retires with four decades of experience. (2019, May 18). Retrieved from <https://www.smdp.com/postal-worker-retires-with-four-decades-of-experience/175621>

2.1.3 Current User Practice

Current user practices consist of moving parcels largely manually, with limited assistance besides the use of a van for road transportation. Hand trucks are often the rudimentary way of moving parcels around floor, and are only seldom used to move items from the van to the doorstep of a receiver. They are used to manual labor and driving, and are particularly skilled at making stops quickly, but it becomes a very repetitive process that's repeated hundreds of times a day. Organizing parcels is also a mental task that helps them make their day efficient but the time involved in setting it up correctly is considerable. Primary users will tend to make their own habits, such as how they organize a vehicle or the way they transport goods, which leaves a wide array of modified workflows dependent on the individual.

Frequency

It's a semi-standard job with varying hours, but can easily promise 40 hours a week. During peak season or on unusual days, it's possible for 5-9 work shifts, 7 days a week, with debatable ethics consideration for break times. The strain can be very mentally taxing, as well as physically tiring, which is a major problem if overly frequent.

Social

Socially, the job is very acceptable and is a huge driving force of today's economy. It doesn't get appreciated as much as it gets flack for late deliverers or damaged parcels. While not expressed, people have a lot of respect for these workers and the way they just make packages appear at your front doorstep. Internally, it's a job that the workers enjoy being a part of, knowing it's honest work, but sometimes gets caught up in labor disputes and unionization.

Location

Work takes place in large warehouses/sorting facilities that have conveyor belt assisted loading areas. They are crowded spaces that have many mechanical components moving parcels and organizing them before the manual loading into vehicles. They are often located on the outer edges of cities, about 30 minutes from the core. Post offices in rural areas are much more common. Roads are urban, which mean sidewalks, pedestrians, dense traffic, one-way streets and narrow spaces. Urban spaces are highly variable and adaptation is a strong lead into these spaces.

Organization

Most of the chronology work is done by numbers provided by the system, which are then processed by the user to put in said area. Tools such as BMC's are used to transport parcels manually. They are essentially a trolley for parcels...very rudimentary. Trucks are loaded Tetris style which Package Cars/Vans have shelving units with a semi-stand able space between for easy finding but generally wasted space in the vehicle. Various other methods can be used but this seems to be the most standard among major companies.

2.1.3 Activity Mapping

These following graphics show the general overview of tasks undertaken by the primary users. As mapping each individual action would create excessive data, most important ergonomic considerations are listed. Otherwise, they are general vehicular tendencies that are common knowledge.

Data is based on evidence from report 5 in appendix D:

		
<p>FIG B1 from http://www.denverbrown.com/wp-content/uploads/2016/11/AEEAAQAA.jpg</p> <p>Phase 1 – Picking Up Parcels</p> <ul style="list-style-type: none"> - Tight spaces - Coordinate with assigned sheet - Organizes manually - Lifts into vehicle by hand - (14" Step) - Places on varying shelf levels - Sometimes pre-bagged for easier placement in vehicle - Improve customization + ease of organization + physical burden 	<p>FIG B2 https://www.ajc.com/business/georgia-business-online-shopping-forcing-change-ups/PFB5WwaneTMpjiuXPjvKJ/</p> <p>Phase 2 – Driving</p> <ul style="list-style-type: none"> - Standard van configuration - Multitasking <ul style="list-style-type: none"> - Driving - Navigation - Visual Awareness - Van requires marginally more skill to drive <ul style="list-style-type: none"> - Weight shifting - Visibly different - Loose parcel - Improve Focus + awareness 	<p>FIG B3 https://www.cnn.com/2015/10/02/ups-sued-for-repeatedly-blocking-new-york-bike-lanes.html</p> <p>Phase 3 - Parking</p> <ul style="list-style-type: none"> - Frequent - Leaves Vehicle On - Difficult to find parking in city - Must be aware of parking laws - Must be aware of surroundings - Improve Security + parking implications



Phase 4 – Making a Stop
Fig C3-5 from <https://www.youtube.com/watch?v=11s14v8lCz4>

<p>Step 1</p> <ol style="list-style-type: none"> I. Checks phone for order II. Finds order, sometimes struggles III. Exits vehicle and checks back if necessary 	<p>Step 2</p> <ol style="list-style-type: none"> I. Open door with package on lap II. Grabs phone / DIAD from holder III. Walks out IV. 2 Step drop 	<p>Step 3</p> <ol style="list-style-type: none"> I. Shuts door manually II. Navigate terrain, pedestrians and other vehicles 	<p>Step 4</p> <ul style="list-style-type: none"> - Lowers package to ground - Scans package with phone or DIAD / takes proof picture - Knocks on door - Returns to vehicle 	<p>Step 5</p> <ul style="list-style-type: none"> - Returns to vehicle - Climbs into vehicle using one hand (opens door if closed) - Places phone / DIAD in holder
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2.1.4 Ergonomic Research

The primary literature resource for this section comes from Alvin R. Tilley and Dreyfuss & Co's *The Measure of Man and Woman*. This book provides significant dimensional and statistical data that helps define the proper ergonomics studied. Basing this research of these standards provides a ground foundation for reasoning the range of static human figures and the motions required to operate a conceptual design. A second book, *H-Point* by Stuart Macey and Geoff Wardle is a staple automotive design book that has many visual references to what makes ideal vehicular "packaging" or technical layouts. It helps provide some insight into what dimensions are required by cars in today's environment, as well as functions needed or possible, such as conceptual compact car designs and pieces of technology (e.g. canopy entry). The Canadian Centre for Occupational Health and Safety also has a public Q&A with detailed answers that help reinforce a lot of standards in work related to driving, that can be heavily applied to this project.

This thesis project requires the use of full body adaption which can entail many things, however the key uses of the product must engage three major body parts that are explicitly outlined in the documents given to students to understand this goal of "full-bodied human interaction design" (Kappen, Thomson, & Burke, 2018). This ergonomic evaluation report will address the typical areas engaged and how they can be assisted and form fitted to assist a wide range of people pertaining to the demographic of the product.

Decision(s) to be made

Ergonomics will focus on these three areas of engagement as specified by Kappen et al, (2018) to improve the positives of the workflow experience while minimizing pain points and frustrations with the proposed workflow.

1. Entry and exiting of the vehicle (legs)
2. Cabin visibility and situational awareness (head neck and shoulders)
3. Use of controls and door access points (cabin and parcel storage) (hand and arms)

The primary method of analysis in this report is a large buck model that tested a seat style virtually unused in the vehicular industry, as a standing driver seat. Feedback was received by several people concerning;

1. The arms reach to a steering wheel as well as the angle the wheel is installed and the size of the ring.
2. The use of a semi-saddle type seat to create comfort for different height levels.
3. The angle of the user's body relative to the ground for comfort of long use.
4. Foot placement considerations for a pedal and significantly more weight on the heels of a user.
5. Range of head motion and height of eyesight relative to the cabin floor.

Model was based on dimensions from Dreyfuss (2002) concerning a 95th percentile man and a 5th percentile woman in a vehicular scenario.

Description of Users Targeted by Product

Parcel Delivery tool users generally fall under a wide range of ages, ethnicities, and physical dimensions. However, the general user is a male, Caucasian in the 45-50-year-old age range. They are physically capable of walking and operating a vehicle. Operation is in the Greater Toronto Area, including the Downtown core. Similar places could include New York City, New York, or Chicago, Illinois. Has a family and two children. May experience muscle pain from repetitive movement.



Conceptual Airplane Standing Seat

(Retrieved from <https://www.insider.com/skyrider-standing-airplane-seats-claims-makes-flights-cheaper-2018-4>)

2.1.5 Safety & Health Research

The primary concerns are of the user stem from repetitive motion. The bare minimum of comfort must be met as a requirement of workspace regulations. The job is a very mobile with little physical security besides the seat of the vehicle. Packages have unknown contents and provide a risk to unknown weights and being overweight, even though monitored by regulations for parcels and packages set by the country/company of origin.

Awareness

A major safety concern with parcel delivery is dealing with traffic on the road and while parked. The keyword here is awareness – the ability people have to address their surroundings and process them in such a way to avoid accidents and be mindful of other people. This is not just important for the security and safety of users but also the parcels in transport. They are someone else's goods that need to be handled with care and responsibly.

Vehicular

As with any time you are on the road, there is always a risk. Driving for long periods of time in urban environments can increase chances of awareness dropping and the chance for the vehicle to run into issues. The maneuverability of a vehicle also determines its ability to weave through traffic effortlessly and without causing issue to other's travels and works.

Mental

As brought up in the interview, the job of delivery is very mentally taxing, with the stress of wanting more delivered and for it to be done on time. This puts exceptional responsibilities on the primary user and can weigh heavily on the mind, causing stress without breaks to manage it. It also leads to tiredness and poor decision making, which raises the risks of driving and the ability for a user to do work, which in the long run, threaten their job.

Weather

A large concern with outdoor jobs is weather and the ability for a user to operate safely. Road conditions are especially threatened by changing weather such as rain, fog and snow. One of the busiest times of year is known for snow. This affects the grip on the road, as well as visibility. A lack of handling can threaten surroundings, as well as the user with the product. Visibility is a major concern as covered in awareness. Handling these situations can lead to slower times and less efficiency, and aren't handled in any better of a way than standard vehicles. (Interviews, Appendix C)

2.1.6 Interview Results

Two interviews, which transcripts are available in appendix C, were taken with delivery workers. The first interviewee was my father, Dan Demczuk who has worked in electrical supply delivery in the urban Toronto area. The second interviewee was an online user, by the name of Ross, who works with the United States Postal Service. Details can be found in the appendix.

Method involves asking questions around the working conditions, including the weather, seating, tools they use (primarily vehicular), and safety on the job. Broad questions often led to more precise impromptu questions that led to the following conclusions.

Interview results have been largely covered in the sections above. One of the largest key points provided by a user in the actual field is that injury and physical stress are very rare, contrary to what common sense entices you to think. While laborious, it isn't stressful given the correct body type. Adjustability is limited in situations, and create problems for both 1st percentile and 99th percentile human proportions.

It's common for users to have a preference on vehicle for different situations, but isn't always available as they want. It's important for a user to feel comfortable in whatever vehicle they are tasked with.

There is a major lack of human amenities in vehicles. One such case was mentioned in an interview where an inner-country postal worker suffered a heart attack due to the lack of proper air conditioning in the vehicle with few possible remedies. The person did not survive, and nobody knew for hours.

Users also wish for ease of maneuverability to make driving less of a chore and less stressful. The better the car handles in adverse situations, the more confident they feel in their ability to do their job.

Loading and unloading the vehicle should be an easy job, and usually is, but there are some situations that make it difficult, such as pallets and extremely heavy loads that may require mechanical assistance. Exceptionally heavy loads are not a part of standard parcel delivery but could also be an area to explore conceptually.

2.2 Introduction to Product Research

In preparation for concept development, benchmarking current tools used by the delivery industry is a crucial step into understanding what is available and can be improved on. This report will strictly work with road-transportation and last-mile vehicles over other tools used by parcel delivery companies. They are the center of the operation and provide information on how other tools can be used around them. Sections will benchmark benefits and features, aesthetic and semantic charts, and a keyword focus.

2.2.1 Current Products Profile

In the appendixes, is a collection of eight delivery vehicles, from common on-road to concept and in testing. While documents on specifications are exceptionally hard to find because of proprietary technology, a list of features and benefits were generated in point form. This section will compare various sources and find common benefits and features that drive product success. Since features are extremely variable, it will be listed as “category for a feature / product spec”. Benefits will be summarized. Refer to appendix notes (sources) for specifics. From these focused benefits and features there, a baseline of common features can form.

Benchmarked Products

Appendix E-1

UPS Package Car



Image From https://en.wikipedia.org/wiki/United_Parcel_Service

Appendix E-2

UPS Nextgen Package Car (ARRIVAL GB)



Image From <https://www.engadget.com/2018/05/09/ups-electric-trucks-arrival/>

Appendix E-3

Mercedes Sprinter Van (2019, 1500)



Image From https://www.mercedes-benz-vans.ca/en/sprinter/cargo-van?gclid=aw.ds&ds_rl=1254851&gclid=Cj0KCQiAno_uBRC1ARIsAB496IVICqCuO18m2ITzXlxDutjI4S2p8JbfiALOB7gwHHmD2fkClcsEHZcaAvtnEALw_wcB

Appendix E-4

FedEx EV Parcel Car (Navistar Estar, formerly Modec)



Image From <https://www.treehugger.com/cars/fedex-adds-4000-efficient-delivery-vehicles-doubles-ev-fleet.html>

Appendix E-5***Kyburz DXP NZ (Australian Post Trike)***

Image From https://kyburz-switzerland.ch/en/delivery_vehicles/dxp_nz

Appendix E-6***Renault EZ-Flex Last Mile Delivery***

Image From <https://insideevs.com/news/345833/renault-announces-experimental-last-mile-delivery-van-ez-flex/>

Appendix E-7***Nuro***

Image From <https://nuro.ai/>

Appendix E-8***Renault AI EZ-PRO Concept Delivery Vehicle***

Image From <https://www.moneycontrol.com/news/technology/renaults-futuristic-ez-pro-is-a-delivery-vehicle-that-looks-like-a-lunchbox-2969381.html>

2.2.2 Benchmarking - Functionality

Features	Sources
Tight Turning Radius	A4, 5
Storage space relative to vehicle size	A3, 5, 6
High security and safety autonomous driving	A7, 8
Vehicle travel range to vehicle size (higher, better, electric vs fuel)	A2, 4, 6, 5,
Lightweight / specialized materials	A2, 5, 7
App empowered	A6, 7, 8

Benefits	Sources
The use of phone apps allows for easier and more convenient pickup times and routing which reduce traffic congestion and wasted fuel/time.	A.6, 7, 8
Electric powered to reduce the impact on the environment and use engine properties that work for stop-go scenarios which parcel delivery is based on. Electric powered also keeps the vehicle quiet to reduce noise pollution.	A.2, 4, 5, 6, 7, 8
Integration into urban environments, including smaller sizes to fit into compact spaces and increase maneuverability easier entering and exiting for user safety tighter turning radii highly aware sensors to prevent accidents and damaged vehicles to save money and employee reliability	A.8, 7, 6, 5, 4, 2
Modularity enabled bodies that can address many different companies needs and the transportation of a wider range of goods.	A.8, 7, 6, 3
Objectively saving money through reduced maintenance costs, worker’s time (A.8), vehicle complexity, and stop/go efficiency.	A.8, 7, 5, 2

Above are 2 tables drawn from frequency analysis of the benchmarked products. They list features and benefits that are prominent across all benchmarks. Generally speaking, efficiency is one of the key words of the industry, indicated by all of the points above.

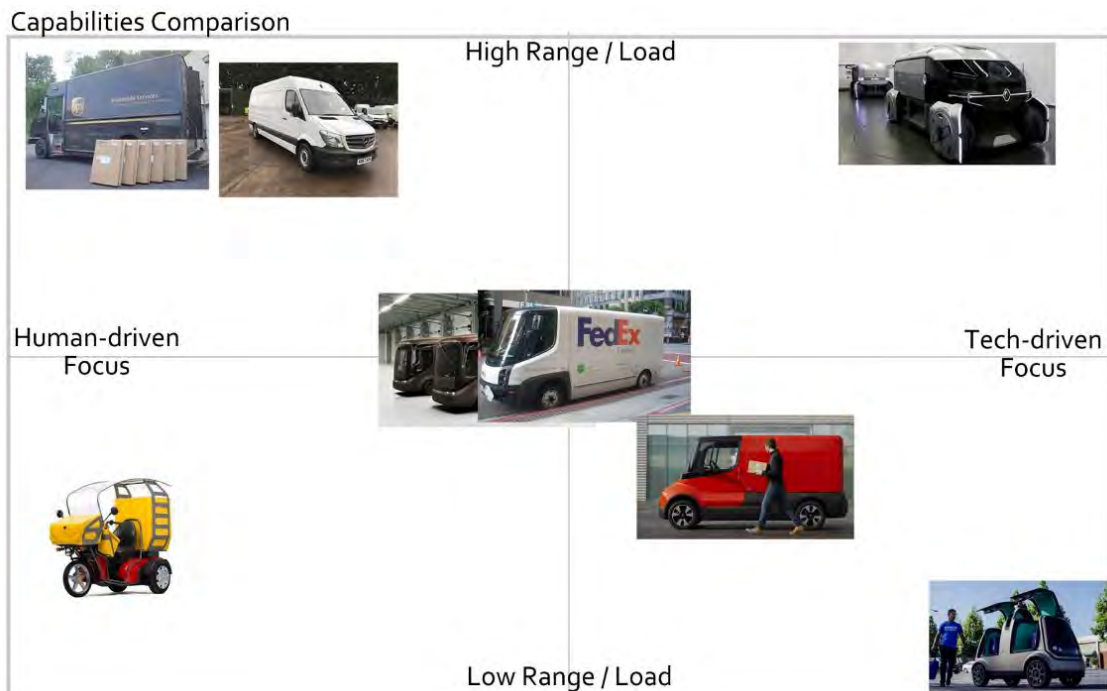
2.2.3 Benchmarking – Aesthetics and Semantic Profile

Semantic Forms

All the vehicles share a similar silhouette with a couple of challenges. The rectangular 4-wheel form is the most iconic of the set, and is driven largely by function, because cubic storage areas are the easiest to maximize space on 2 axles for road use. It lets people know that there is lots of space within to hold cargo and that they are used for the transportation of goods.

Semantic Workflows

“Especially innovative products rely on semantic clues to help communicate proper use and thus minimize the need for instructions” is an important statement made by Krippendorff and Butter (1984) that drives an ease-of-use quality for all products. A high advantage and disadvantage of vehicular design is its solidly defined structure which people know how to use; but this also makes it hard to add new features without confusing people. When designing, it will be important to visually adapt any additions to make work how it appears. The EZ-PRO in the appendix (E-8) has a unique form, but it’s hard to read how it’s used. When deployed, it will expose a locker type system that looks complicated. People who want to just grab a package will find this more difficult than just being delivered to their door. The Nuro (E-7) however, has 4 easily defined compartments. As also mentioned by Krippendorff and Butter, the use of “informative displays” such as touchscreens can help influence the use, which the Nuro has compared to all other products listed.



Pictured above is a metric comparison of functionality by form for the purpose of showing what different values influence appearance. Visually each vehicle has the appearance of their capabilities. The larger vehicles are meant to carry larger payloads over longer distances, but lack the compactness for central items which hold less but have a good payload for class. Lower range vehicles are compact with limited deliveries. Traditional forms have more of a human driven focus in the sense that they look like vehicles that people can pick up and drive off the lot of their dealership. Middle of the line have odd changes like lack of driver side doors and central seating that are harder to adapt to. The tech driven focus are new forms that don't relate easily, such as the front-loading cockpit of the EZ PRO. The Nuro drone has 4 highly visual doors which helps drive its usability. There may be an advantage to a vehicle that has both human and tech driven functions that make it relatable but can take advantage of newer technologies.

Aesthetics

While iconic, the visuals of transportation vehicles on the road today feel very business oriented, such as the Sprinter, or just a straight up task rabbit, like the package cars that FedEx and UPS use. This does make sense because they are often bought out of the need to do work; and want to be viewed as such tools. However, there's a lack of personality that are presented by the current products. They don't excite people. Newer models are bubblier and have that sense of airiness to them which make them feel more approachable. A push for urbanization rather than industrialization can be visible when comparing the concept vehicles to the traditional. Using silver steel panel aesthetics with a black accent, assisted by lights to create a urban-chic form. The Renault EZ-PRO (E-8) does have some roots in the industrial look; but has the futuristic surfacing that inspire people and peak curiosity about the vehicle. It takes advantage of the required rectangular and make it look almost architectural with the square wheel covers. It tries to add angular facets, where possible, to break the traditional forms which appear boring.

There appears to be a certain lack of ruggedness for a vehicle that should be robust and appear secure for its packages. The DXP (E-5) is a trike form that has an ATV like aesthetic, combined with a business transportation look encouraged by the boxy “loaded on” pieces. While it’s not the cleanest design, it does push the idea of where these kinds of vehicles can go visually and functionally.

Aesthetic Comparison



Pictures above is a matrix comparing the benchmarked products against their form factors and configurations. There appears to be a chance to make a medium-sized transport for inner city delivery that has a unique configuration capable that can create a new aesthetic inspired by the central aesthetic.

2.2.4 Benchmarking – Materials and Manufacturing

Current materials are non-advanced. In order to keep a low cost of ownership, many vehicles in delivery fleets are made out of easily replicable and high lifetime parts/materials. As a push for fuel economy, vehicles will be made of thin aluminum to save weight, with limited concern for denting. Engineering plastics can help with light weighting and toughness while providing adequate resistance to weather. Many vehicles can be repurposed for other jobs, essentially recycling the automobile or upgraded from existing builds (such as the DXP, Appendix E-5).

There is a large push for electrical vehicles which is a considerable shift in how automobiles are manufactured. Having the proper sized battery will be important to route considerations and vehicle life/cost of ownership.

Tertiary users will be very keen on the numbers shown for cost of ownership, and how much this vehicle will cost them in the long run. The use of the above considerations will be important in making a marketable item that is efficient enough for the high-requirement sector.

Transportation vehicles today are made of traditional automobile materials, including steel structures and assorted selections of steel panels, aluminum. While plastic is a popular use for light weighting bodies in commuter cars, it isn't a popular choice with package cars. These vehicles tend to rely on thin flat steel sheets to make up the cargo portion of the vehicle while reserving the costs of the more expensive steel for the cabin. Standardized parts lend themselves to commodity plastics and basic steels. Relatively cheap automotive paint helps the vehicle identify with a brand and protect from rusting and corrosion, but has less effect against scratching.

Package cars tend to be very limited in their processes to keep them cheap to manufacture and easy to replace, while retaining a long life. Much of the sheet metal used is kept flat to retain volume and increase repairability. Vans are often covered in visible rivets that hold the steel to the hull. Internal body is rectilinear and flat, often with treaded steel plating on the floor for simple grip. Wheel wells are non-contoured. Vehicles are largely made through stamped edges and vents. Reinforcement is done through bent metal runners on the broadsides of the vehicle at sedan level. Latches, hinges, handles, and miscellaneous parts appear stock, Body plastic is limited to edge banding and small features such as gaskets and headlamps.

Finishes are rust-resistant electroplating. Aluminum is a popular alternative for its non-rusting nature. The bodies are branded in a semigloss automotive paint, with vinyl graphics.

Non-specialized transportation vehicles put more stock in visuals of the vehicle, adding more comfort and form contouring plastics internally and form-stamped steel on the outside (such as the Mercedes Sprinter). Modern delivery vehicles like the arrival benefit from modularity to create easier to manufacture and repair EV transports.

New Materials, New Technology

While not largely employed in fleet transport vehicles, it is becoming increasingly popular to use high quality materials like magnesium and carbon fiber reinforcement to improve the structure of vehicles. This impact both their safety and their environmental ratings. Electric motors and hydrogen electric engines are on the verge of mass deployment and are necessary to the standards of tomorrow. High tech soft materials that are highly durable and weather resistant while remaining light and manipulatable will help encourage modularity and safety of vehicle contents.

Vehicular technology is cutting edge as is, and keeps evolving. Two upcoming trends that dominate the future automotive market are electronic motors and autonomous driving. Major and upcoming companies are engineering these types of electronics to be outfitted to traditional vehicular design. Many companies such as LeddarTech are looking for opportunities for their technologies to be integrated into various aspects of life's jobs.

BMW developed a concept car called the Gina that used fabrics to create a lighter, moldable car that has extreme light weighting benefits. (Boeriu, 2014) While it never developed further than the concept stage, the use of engineered fabrics to create facets of the vehicle could be used in the cargo compartment of a vehicle. Existing proof of this concept is in covered flatbed trucks often transporting steel supplies in the Greater Toronto Area.

Heads up displays are a futuristic concept that are being explore in products such as Google glasses and car speedometers. The goal is to make information within eyesight so the user can stay focused on the task at hand. It uses glass refraction to create a transparent look giving the user a greater sense of space and awareness.

2.2.5 Benchmarking - Sustainability

Current products have a focus on fuel economy, the baseline for sustainability in the automotive industry. However, it's only the surface of what sustainability means. The important elements that make up a sustainability factor include engine type, durability, material selection and its efficiency. Data for this section largely comes from facts in appendix D.

- Engines determine which type of fuel is consumed by the vehicle and have a massive impact on that fuels supply and demand. The world is driven by gasoline, but alternatives are available

such as diesel, propane, and ethanol. Electric engines are becoming mainstay in newer products but are subject to where they are receiving electricity from, to determine their impact on the environment and supply chain. There is a place for physical energy engines, such as bicycles and push able transports, but goes against the user needs of this project's findings in chapter 2.

- The durability of materials determines the lifespan of a product. From the choice of material to the way it is used, parts need to be analyzed for maximum lifespan potential. Companies look for the lowest repair and maintenance costs in vehicles in order to increase their profit margins. Premium materials are still subject to wear, so it's widely accepted that vehicles should be using cost-efficient engineering plastics and steel/aluminum to create the body of a vehicle. The more parts that can be repaired easily increase lifespan of the vehicle with a positively disproportionate cost of ownership. Electric engines may have a better impact on gasoline usage, but large battery sheets are non-recyclable and break down quickly in terms of years. This makes their sustainability questionable but it is a fast-growing technology that has seen advancements from companies such as Tesla.
- The efficiency of a vehicle is a major role in how many resources it uses and the impact on the environment around it. By this, it is referring to the ability of a vehicle to do its job, not the conversion rate of energy. If a product is spending more time trying to accomplish a task, it is wasting resources. This is why payload capacity is important to product buyers as it allows a person to move more supplies with less input.

2.2.6 Interview Results

Interviews (Appendix C) returned facts about both the Mercedes Sprinter and the Grunman Long Life Vehicle (LLV) which both users have experience with. The key facts obtained from the interviews are as listed;

- Companies don't care much about the damage to a vehicle as long as it hasn't involved someone else's property. If its running, has a logo, and can deliver, it can be fielded.
- The LLV has the driver's seat on the right side to make it easier to access mailboxes.
- Vehicles are made to make right hand turns most of the time.
- While the project is focused on small package delivery, large packages are not uncommon on to the tools and should be accounted for. An ability to carry pallets might be something to consider.

- The Sprinter Van is more accommodating than it seems. Despite the large size, it's easy to handle. Its storage area is spacious but lacks proper organizing and securing. A large concern is the drop from the seat to the ground, and need to travel around the sides. Two door entry allows for things like pickup/drop-off to be organized better.
- Drop off zones can be chaotic and waste a lot of time. He had to use external tools to help offload larger orders. Loading and unloading have many things to consider. Concerned for loading docks and other types of platforms.
- Weather is a major factor for Canadian delivery. Snow is the biggest hazard both in the car and on foot. Amenities, such as air conditioning and quick defrosting abilities will help greatly, but sound like they could always be expanded on. Crosswind is a major concern as well, with tall vehicles.
- The name of the standard postal vehicle used by USPS is the LLV, known as the Long-Life Vehicle. It has an aluminum frame that is very weak but fuel efficient. It limits its amenities to make it more cost effective and some are in service more than 30 years.
- The RAM Promaster is better than the LLV when it comes to parcel transportation due to its size and payload.
- Turning radiuses are very important for Cul-de-sacs and narrow driveways. The driver's seat is opposite to allow access to mailboxes. Visibility is questionable and some mirrors are creating blind spots that require far stretching.

CHAPTER 3

This chapter will cover the analysis of the data and the primary needs that the user wants out of a new product that is a mix of inferences and benefits derived from benchmarked products. These points will be compiled into a point form design brief which will provide an understanding of what concepts should be aiming to achieve in able to make a marketable and successful product.

3.1 User-Needs Analysis

Developed by the research gathered in appendix A, a statement of need was developed as a way to define the users core desires and what would be the most fitting attributes to give a final product to improve the usefulness of it.

Statement of Need

The transportation of parcels is a necessary job to move goods to an individual in an efficient and comfortable manner for both the worker and the packages which should be treated with the upmost care and control (security). The transportation also needs to be easy for the worker to manipulate the environment of the product using efficient engineering. They must feel able to act autonomously with such products and cargo. They must have the confidence to handle loads and feel accomplished about being able to move people's belongings to those people.

List of Needs

Loading Assistance

Any sort of help in loading the packages into the vehicle can be appreciated as it's less mental and physical work and has the potential to be faster. Currently large warehouses will use a Preloaded to organize the package cars, however this is treated as a user and is their need.

Ease of Driving

Adding the ability to drive with less multitasking and more focus can lead to a clearer mind and an easier work day. There's enough to be concerned about in the city when driving, so improving these conditions is a definite need of the user.

Ease of Navigation

The user is given a automatic route thanks to technology, but still have to refer to a small phone dash and rely on their visibility in the cab to see signs to catch roads. Missing roads is very time consuming in the industry so improving this ease is a need.

Safety of Vehicle

Like anyone in a vehicle, its important to feel safe. Current vehicles have few guards but adequate for vehicular transportation.

List of Wants

Customize Workflow

Current users tend to develop their own workflows and how they want to organize their vehicle and will try to adapt to do so. A new product can be modular and have the ability to do multiple common tasks which give the user more personalization, on both the personal and company level.

Avoid Long Work Hours

Working overtime leads to numerous problems which are against the well-being of the user. This want is hard to control due to demand of the products, but attempting to make a more successfully productive system can help alleviate this want.

Lessen Physical Stress

Everyone wishes that they could not exert themselves as much and achieve the same result. While not a major need, it can be appreciated to lessen the physical workload so they can be more awake and happier on the job.

Lessen Mental Stress

Taking the pressure off of the user to deliver a massive amount of orders can make the job more accessible and appealing, and take the edge off during their time at home.

3.1.1 Needs/Benefits Not Met by Current Products

Current products are all trying to achieve the needs to some degree. Some in a very minor way. Most products are currently doing the bare minimum to get by in order to keep operating costs down. The most unmet need would be assisted loading/unloading, which is all done manually at this point.

Many of the benchmarked products have a wide array of features, from AI drones to updated versions of currently used vehicles.

3.1.2 Latent Needs

The primary user seems very content with their position from the interviews and media studies, but logically there appears to be issues in the system. These needs are latent and should be addressed. These issues include

The Elimination of Excessive Movement

Many users are comfortable with the physical requirements of the body and don't appear to get injured. However, having physical exertion is naturally a strain on the body. The main reason to eliminate steps in the process, however, is to reduce the time it takes to do a task. Rethinking the workflow and trying to remove steps, such as entering/exiting the vehicle or reducing the number of stops, can improve the ability of the user through product.

Increase Organizational Ability

The organizational system currently used takes up more mental stress and physical ability than what it could potentially be. This will also improve the efficiencies in the system and reduce the amount of time to complete tasks. Not many users acknowledge this want because they think the system that is given to them is absolute with little variation.

Job Security

The industry may be very robust and hard to be ejected from, given a union and basic concept, however mental stress can build up in peak seasons, which are not relieved by breaks. There is a building want to quit because of being overworked, but the need for job stability counteracts this. This can leave the user in a loop which can hopefully be relieved by less intensive product usage and letting the product do more of the work.

Need for Awareness

Awareness is a natural ability for users to be alert about their surroundings, and is often taken for granted. The better their awareness, the less chance of high impact accidents to happen and less inconveniences to people around the user and product. This can also improve the security of the parcels being shipped and the condition that they arrive in.

Tertiary – Happier Staff and Customers

The organizers of a company have a big role in the product as it's their piece of equipment they give to their workers to help their customers. Most businessmen will think numbers and be focused on the features of the vehicle rather than its human benefits, which can make staff and customers less happy in the long run. If both can be appeased, the product will have an edge above the competition.

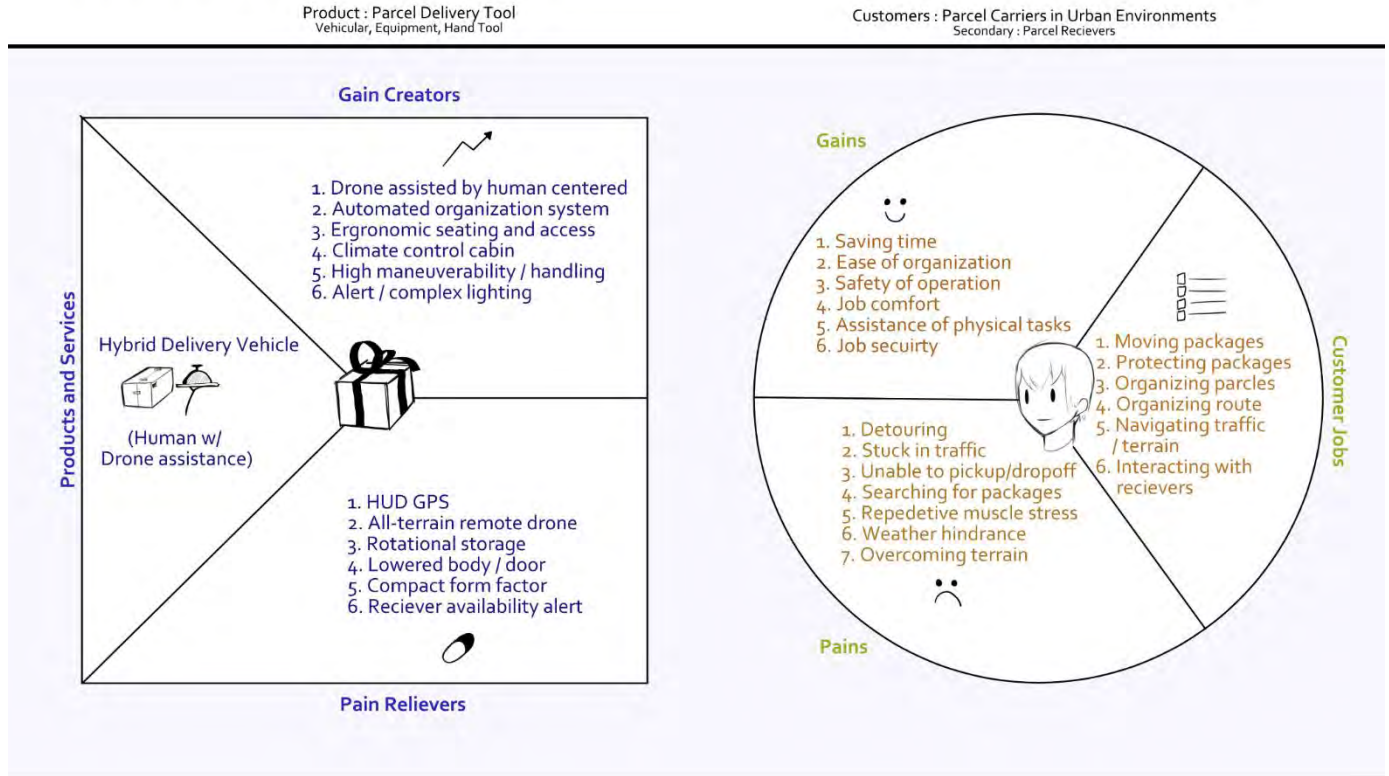
3.1.3 Categorization of Needs

The preceding sections create a list of needs required by the user. Summarized, they are;

- ***Loading Assistance***
- ***Ease of Driving and Navigation***
- ***Safety***
- ***Modularity / Personalization***
- ***Lessen Stresses***
- ***Security (Physical)***
- ***Security (Job & Income)***

3.1.4 Needs Analysis Diagram

Value Proposition Canvas

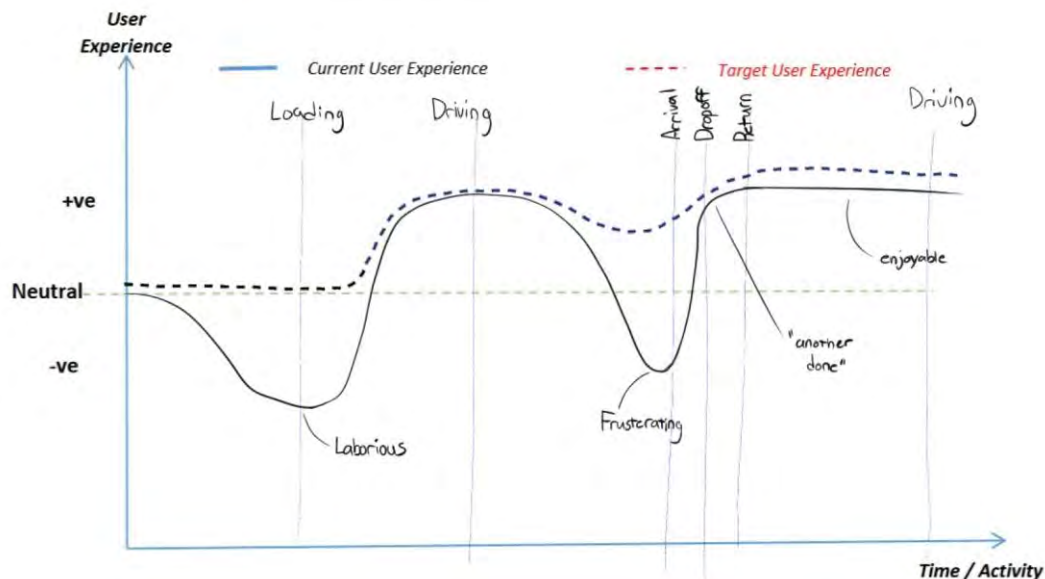


To best illustrate the needs and how they're addressed with a potential new product, a Value Proposition Canvas was made. This shows the user and their Pains and Gains that they want/need. Functionalities derived from research are proposed in a new product on the left. Many connections can be drawn between the two sides and how the potential product fits into the values (or needs) of the user. It will be important to include these features on like-minded ones in the final design to match the values of the users.

3.2 Functionality

Delivery products have a high focus on functionality being a workplace tool. Many investors are interested in how it can reduce times for the worker in order to be able to deliver more packages. It's important to retain a lot of functionality from previous products, or at least the end benefit. Primary function involves movement from point A to B, which is done in stop and go situations which are best supplemented by the use of electrical energy, tight turning radii, compact form factors, and easy to enter/exit the usage of the tool. Packages should be handled in secure areas that have little room for movement, and would be best in tandem with a rotational storage system for the benefit of accessibility and security.

3.2.1 Activity / Workflow Map



Pictured above is the ideal look of a curve during the process of the delivery. There are two major areas that can be improved which will be focused on in concepts. This includes the loading/unloading phase which has a high labor load on the user, and the arrival which can lead to many frustrations such as finding a parcel in a cramped space and finding parking spots.

3.2.2 Activity Experience Mapping

Listed here are the key activities of the job. Highlighted are points of potential improvement across the board that should be considered to make an objectively sound product.

Activity 1 – Loading Parcels

Laborious – organizing many materials

Ease of prep – packages pre-loaded in bags

Potential to improve loading process; make it intuitive and autonomous if necessary

Activity 2 – Driving

Easy – if you enjoy driving

Multitasking – watching GPS and all blind spots constantly while being aware of cargo

Heads up display could encourage less head shifting and assist multitasking

Activity 3.1 – Arrival at Stop

Multitasking – crosschecking references and making sure everything is right

Frustrating – finding the package in the load

Potential to improve how they find the package through rotational storage

Activity 3.2 – Approach + Dropoff

Quick and easy – use of phone makes tracking easy

Interaction – may interact with people briefly

Potential to improve approach by eliminating and using drone technology from the seat of the vehicle

Activity 3.3 - Return to Vehicle

“Another one done!”

Potential to improve re-entry to vehicle by adjusting the parameters of the van; door positions and forced workflows

3.3 Usability (Ergonomics)

This report will focus on these three areas of engagement as specified by Kappen et al, (2018) to improve the positives of the workflow experience while minimizing pain points and frustrations with the proposed workflow.

1. Entry and exiting of the vehicle (legs)
2. Cabin visibility and situational awareness (head neck and shoulders)
3. Use of controls and door access points (cabin and parcel storage) (hand and arms)

Appendix xi has diagrams produced as the results of the research in chapter 2 that were used to produce a physical mockup giving analytical data on a vertical seat.

Driver Seat

As pictured, the primary area of study was the seat. The concept of a standing seat was inspired by a experimental type of air travel seating. The first drawing was done using the Dreyfuss references in a different posture, The seat itself is made of a a saddle like support that allows the legs to stand with a slight angle on the knees.

The pros of this kind of seat raise the body up to improve line of sight, while keeping the vehicle low to the ground for easy access. The head has an easier time turning and improves awareness. A slight lean in the whole chair allows for resting against to support long trips, and encourage better posture and the use of the headrest that would be positioned to cradle the neck.

The wheel height needed to change depending on the user. Having vertical adjustment would be preferable but angular is probably just as ideal. Having the feet below the wheel greatly reduces the length of the cabin and allows the vehicle to use its space more efficiently and still take sharp turns.

Feedback from anonymous participants had some key points

- The back angle was too leaned back to the point of being awkward. A more upright position is natural. Reduce angle by about half improves longevity of sitting.
- The saddle was very rigid in this design. Contouring should be carefully analyzed, relating to a motorcycle saddle but wider and more support for the legs rather than just on the crotch.
- The seat angle relative to the floor and the back angle is preferably adjustable depending on how much buttock support is wanted over heel pressure. Also helps with body types, and a larger seat is preferable for people with more depth.
- Fine tune the headrest to support the neck when upright, rather than leaning the head back.
- Armrests will help take pressure off the heels. Including swing down armrests would be ideal to deal with various heights.
- The wheel is more comfortably dependent on the width of the person. Larger is generally easier to manage for a wide range of body variations.

The biggest concern with this type of configuration would be the pressure on the heels for extended amounts of time. It would be similar pain to those who have to stand on their feet all day. Especially when the pedal is being used by the right foot, more direct pressure will be applied making control harder, and should be responded by a firmer accelerator and a slow acceleration to accompany

large loads and careful city maneuvering. There is also the option of changing the accelerator from a pedal to a hand control on the wheel.

The ability to change the seat into more of a traditional car seat for long distance travel may present a strong case after more investigation.

The chair is a good start to what could be an innovative take on the driver's seat that specifically accommodates the needs of the delivery worker in urban environments.

Limitations and Conclusion

Identifying critical human dimensions affecting product use were as follows:

1. The seat has significant pressure on the heel without proper buttocks support.
2. The angle of the entire chair should be shallow and nearly upright or it becomes an awkward slouch
3. Wheel height needs to be more adjustable than standard vehicles due to more vertical variance than standard car seats.

Limitations are primarily driven by the size of the project, being a 1-man thesis creates a rushed sense of considerations that otherwise could be explored with a larger team. This is especially true for vehicular design, that has many complex considerations that marry together. It intended that this whole project touch on as many aspects as possible to determine what needs to be key in selling a design as a concept.

Theorized Ergonomics

Car Handling

The minimum space needed under the car is 6" to clear curbs.

The turning radius of the vehicle is an important feature that should be kept as tight as possible. This is achieved through a smaller wheelbase and the use of 4-wheel steering. Four-wheel steering is relatively ineffective on small vehicles; but on larger transports, it can completely change the feeling of the vehicle. Sharp turns make parking easier and city roads more traversable, while also making lane changing easier and safer. This would need to be a necessary feature to access more parking for deployments and deliveries with the system.

Driver Dash

The dash area requires room for speed gauge, fuel gauge, and a heads-up display for transportation, ideally in a place that has the least distracting impact from forward view of the road.

Autonomy Mode

This vehicle will have the option of being autonomous with a cabin for a concierge that can-do administrative work on the go. Considering the heads-up display could be a computer with touch controls requires a new posture.

Cockpit Access

The access to the cabin will most likely be a canopy entrance. This will involve assisted lift of the door and specific handles that should address all body heights. This also includes shutting, which may be electronically controlled by a button. Side entrance should be explored too.

Storage Access (On-route delivery)

On route storage access should focus on having a not-too-high-or-low access point that mechanized systems bring the parcel to. If not, the full range of access should be reachable by primary percentile users.

Storage Access (In-house loading)

In house loading should work with docking areas to provide even ground access to the compartment for easy organization by staff. Automation may help reduce bending and over extending height to place packages on shelves.

Vendor Access (On-route delivery)

Vendors should provide packages at ideal heights akin to mailboxes and the like, to make the pickup as less intensive as need be for a wide range of customers, that may include elderly folk or wheelchair users.

Vendor Access (In-house loading)

Vendors should be accessible at loading docks by directly loading into the open face of the machine. Small packages intended for these machines should not have a heavy strain on the user but ideally will still minimize bending and over-extending.

Alternate possibilities for the future

Additional studies that could improve the viability of the design include:

1. Vendor ergonomics and the loading/unloading of parcels should be addressed with physical tests.

2. The full cabin should be simulated to indicate visibility and clearances to reduce the amount of theory used in the final design.

This ergonomics study helped test-drive a new type of seat that was purely theoretical up to this point. It will help drive the final design and has created a wide range of points to consider when finalizing the concept for presentation.

3.4 Aesthetics

Major aesthetics in current day products appear to be very industrial, with little focus on look to maximize space. While square features are ideal for creating storage areas, futuristic-realistic concepts lean towards the sleek and fast appearance. An Urban chic of sorts, with a focus on high-tech surfacing and appearance to implicate the complexities of the delivery system.

While section focuses on the vehicular semantics alone, there's plenty of room for innovation in the industry when it comes to semantics and aesthetics, wanting to push new directions such as the DXP and EZ-PRO. It's important to make it easy to use because of a rotating workforce and so many potential receivers, and driving it through the use of interfaces that people have become familiar with. Combining the elements of new and old will create a familiar yet urban design.

3.5 Sustainability – Safety, Health & Environment

The push for electrical vehicles in the most obvious improvement required compared to most vans out on the roads today. It's also important that tools have the ability to last a very long time, using stronger materials and longer lasting batteries and components. Due to high use, vehicles can cycle out in as few as 4 years. Easy maintenance is considerable important for large companies. Upkeep costs should be kept to a minimum in both time and money to save them and the secondary user in the long run.

Safety is very important in the urban area, especially when parking. High visibility lights around the vehicle will improve the security of the worker and keep people aware around the vehicle. Possibly using a running light feature could make it more alert. The use of security cameras is idea to watch the van while the driver is potentially away to keep goods in check, being other people's property. Motion sensors should make the vehicle autonomously aware of its surroundings at all times for the benefit of everyone and everything in its proximity.

The key idea around this thesis project is changing the workflow to balance the efficiencies that the metropolitan spaces offer. This is to reduce time on the road and the wear on the vehicle, which is ultimately more important than its ability to use materials more efficiently. Reduced time on the road can be translated by using it more but reducing the overall volume of vehicles required. This vehicle will also serve different objectives from current parcel transportations to allow it to excel at particular tasks rather than replace highly efficient designs for general use.

3.6 Commercial Viability

A product in this category, if well designed, will have commercial viability to upgrade fleets to better accomplish the task of parcel moving. As companies are created and older businesses get outdated, vehicles there will be a need to upgrade or replace. The need to deliver packages is ever on the rise, as long as the world is functioning. It has become an integral part of society since it was possible. The goal of the design is to have features that give it a sense of belonging among similar products and taking a different approach to fill a niche in the industry while also being capable of doing standard jobs.

3.6.1 Materials & Manufacturing Selection

The final product doesn't need any special materials to function as a vehicle or put it above the others.

Primary components would include:

- Aluminum frame to reduce weight and increase fuel economy. Long lifespan and recyclable at end of life.
- Automotive polypropylene for aesthetic paneling.
- Fiberglass bumper parts that can be easily replaced in the case of maintenance or accident
- Standard electrical engine with Lithium Ion Battery pack that has replaceable qualities.
- Steel for integrity and core structural pieces.

Production methods would be assembly lines that are supplied by automotive part manufacturers on commission, standard practice for vehicular production and is highly efficient, even in smaller batch orders. To reduce prices, simplification of body parts could be critical during the design process.

Injection molding would be tooled for primary aesthetic panels, while other parts could be produced

from standardized steel or aluminum parts. Price is reduced as more standardized parts are chosen. It is likely that this thesis will not be detailed to the point that engineered assembly is capable, as it requires the specialty of more than Industrial Design.

3.6.2 Cost

Products in the category of cargo transport in medium scale need to be relatively affordable for small companies and also for large companies to buy in large amounts. The aim of the product will be towards that of a larger company with more specialized vehicles. Vans in the range of \$50,000 USD are commonly used among delivery companies which they own or outsource from a rental agency such as Discount. Benchmarked products are largely special commission vehicles that have hidden costs to the public eye that I could not find. By approximating it with the Mercedes Sprinter and the Nissan NV Cargo was this estimate created. The advent of electric engines puts them at a current premium and could double the cost of a vehicle. These are MSRP prices. The cost of a luxury car in the range of \$50,000 makes as much as 20% profit (Im, 2018). Reversing this gives the approximate manufacturing cost of \$40,000 per unit. If producible on a scale similar to a luxury electric vehicle the price of a unit is in the range of \$50,000 to \$60,000 using standard technologies and materials available to the industry.

3.7 Design Brief

To simplify the brief, it will be summarized as a section of 10 benefits, needs, features, and semantics that will provide guidance for an end-user focused delivery product during the development phases.

1. Efficiency

This is the most important aspect to the product despite all of the humanizing needs of the user. If the job can't be done as efficiently as its predecessor, if not more, it will be exceptionally hard to market. On the brighter side, the more efficient it is the easier the job will be as it should be taking away physical and mental stress from the worker and processing it through the product, saving time and energy for the same or improved outcome.

2. Security

The user should feel secure in using the product. The people around the product should feel safe. The urban core is a bustling place with many different activities taking place and people moving. Measures should be taken to reduce and eliminate potential threats to security. Additionally, the safety of the vehicle is also included. It must be accident-ready in the case of an emergency and have forms that address safe use.

3. Awareness

Hand in hand with security, awareness is a major concern of the product, being able to effortlessly know what's happening to and around it at all times. This includes a clear line of sight and technological instruments that are easy to use and improve the multitasking capabilities of the user. There's already enough to be aware of in the city, and this product should integrate smoothly.

4. Technologically Integrated

The product should take advantage of technological advancements and prove its worth through features that benefit the efficiency of the unit. It should integrate with all other points in a solid way and not attached as fluff. The urban center is being more and more intertwined technologically and should have the ability to fit right in.

5. Ergonomically Adjustable

The parcel delivery force has a wide range of ages and sizes working for them, and as a very high-in-demand job there shouldn't be anyone excluded from the possibility of working as long as they're physically able to do the labor. Adjustable sizes and lines of sight are important for

any worker to be efficient and aware. If there is the potential for secondary users (receivers) to interact with the product there should be ideal heights to interact with the product.

6. Urban Blended

The form factor should adapt to the small streets and sharp turns of the urban center. It should allow the user to exit and enter the vehicle with little concern for being out of place. Visually the form will be rugged yet smooth, reflecting the metal and concrete of the city's core. A splash of color can add personalization from the company of operation and have clear logo legibility as required by today's businesses.

7. Visually Understandable

The need to train people on the spot is quite important, given the large workforce. A new product should be easy to understand and not require extensive training to work. Automation and technological integration should make the process more streamlined and those times that the users must interact with the product should be intuitive to save time and effort, as well as mental pressure. This stems largely from semantics.

8. Low Cost of Ownership

A point for the company owners and those with purchasing power, the product needs to be able to function with limited replacements and maintenance. The more parcels in can ship with fewer operating costs and will assist the bottom line and make more affordable shipping costs or company profits. Only include the necessary and do not try to overly fluff the function.

9. Modular

Modularity is important due to the amount of jobs current products can be tasked with. In special scenarios there could be unique configurations that it can switch to in order to fill an even wider range of jobs. This is true for vehicles like the Sprinter and Promaster. Additionally, people like creating their own workflows, where possible, so having that choice will make them more contemporary.

10. Easier Interaction with Parcels

Being able to move parcels is the most important part of the job, so the user interaction with the artifacts are significantly important. Proposed workflows should handle parcels with care and make them easily accessible. This should follow all the other points, and be efficient, intuitive, and ergonomically sound.

CHAPTER 4 – DESIGN DEVELOPMENT

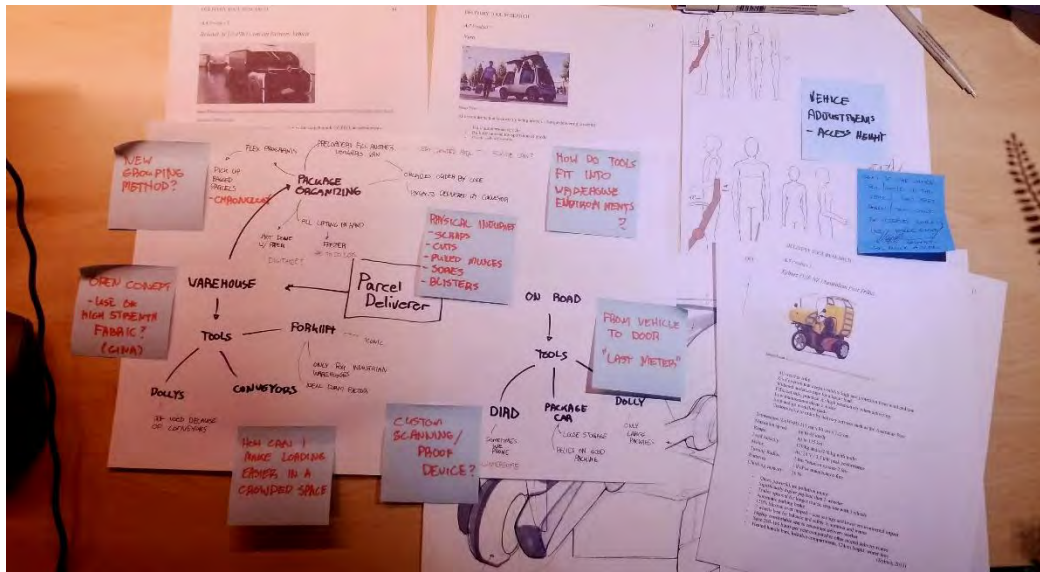
This chapter will showcase the process of design through sketching and modelmaking to come to a finalized design capable of solving the problem of parcel transportation in a metropolitan environment. Early designs will explore multiple packages and layouts to show multiple methods of adapting to the various parts of an urban core. Later designs will focus on a specific function and explore details to help accomplish a specified task.

Authors Note

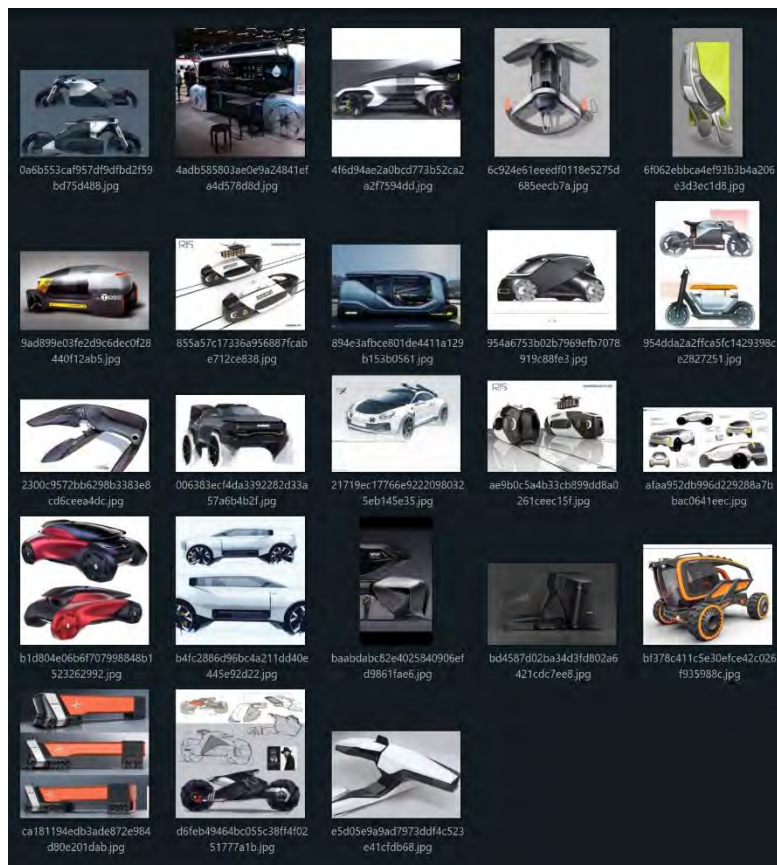
Due to the Covid-19 restrictions I was not able to scan certain drawings properly and did not have the appropriate tools at home to represent the drawings. Will update when and if possible.

4.1 Ideation

Mind Mapping

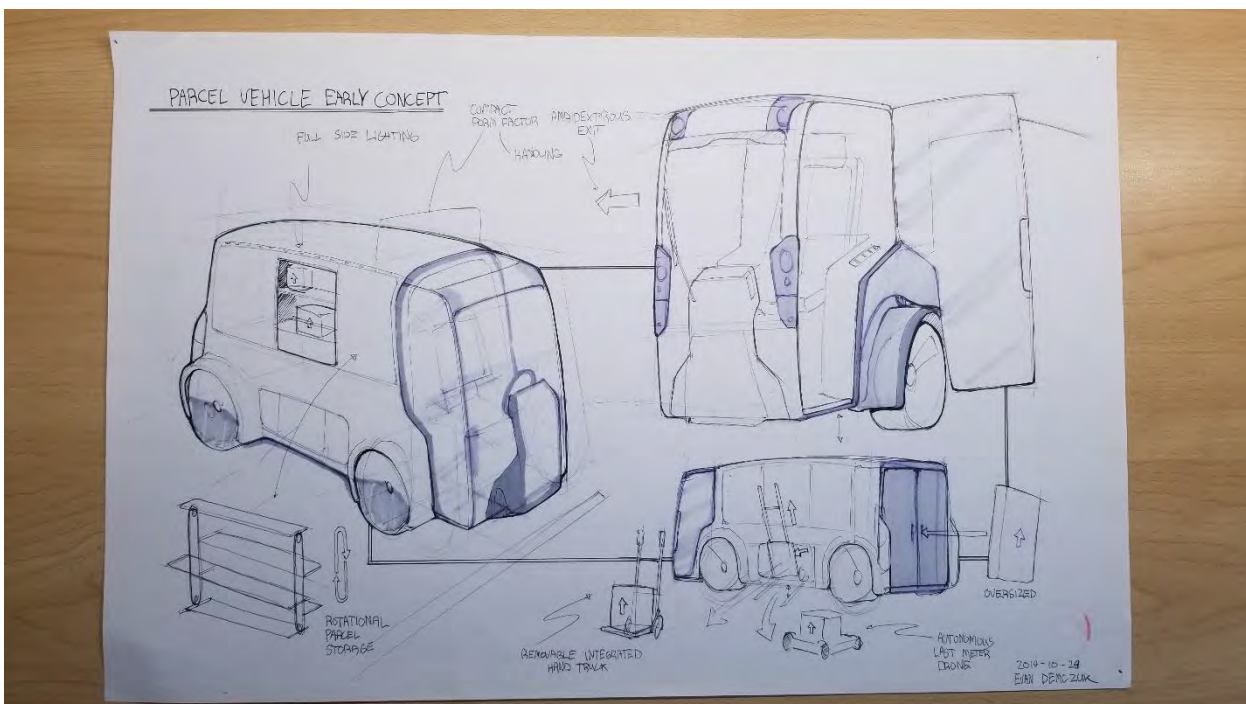
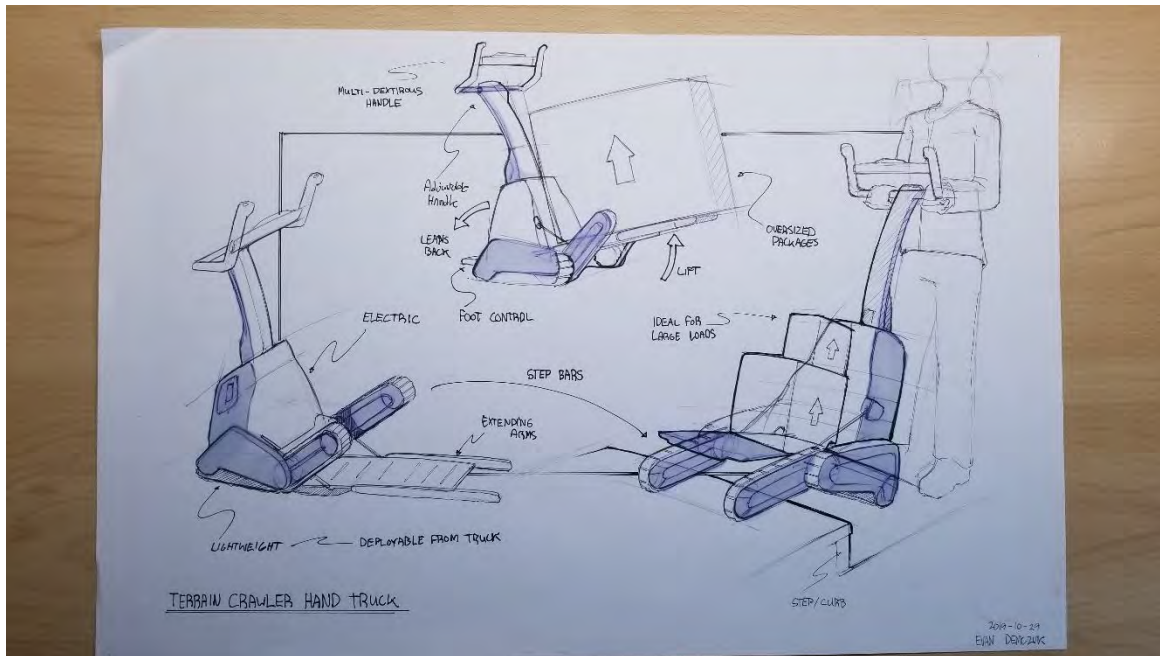


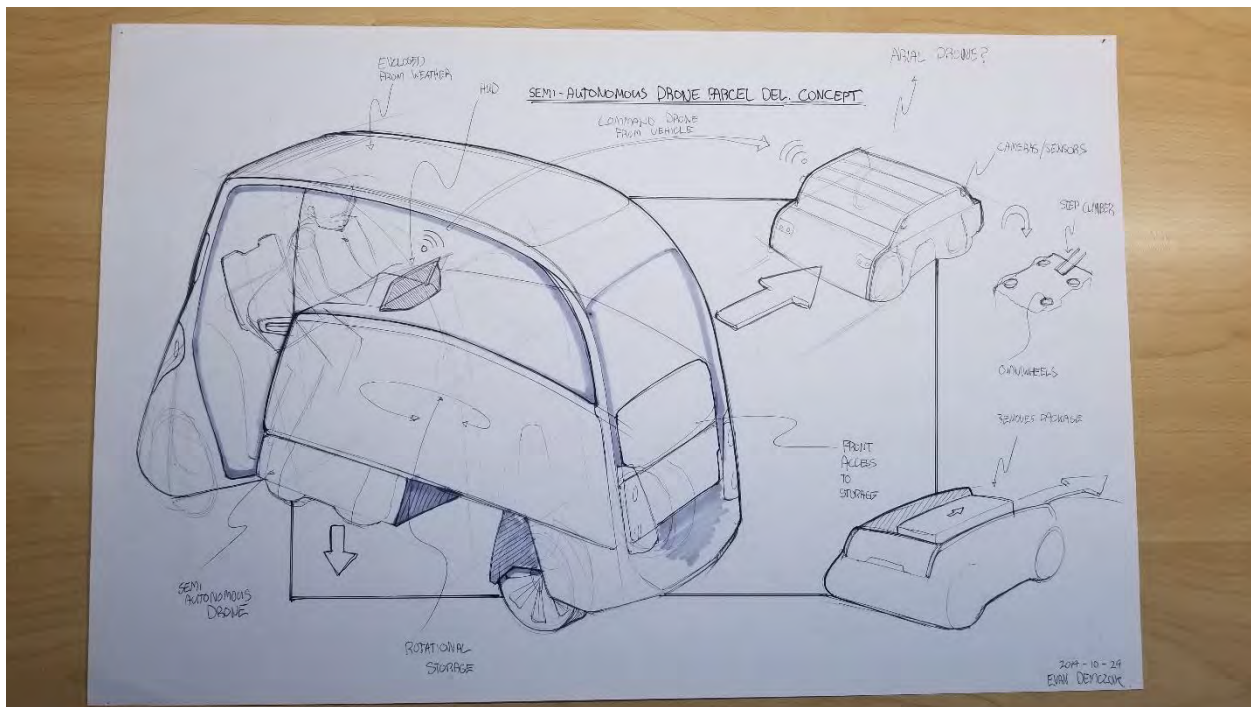
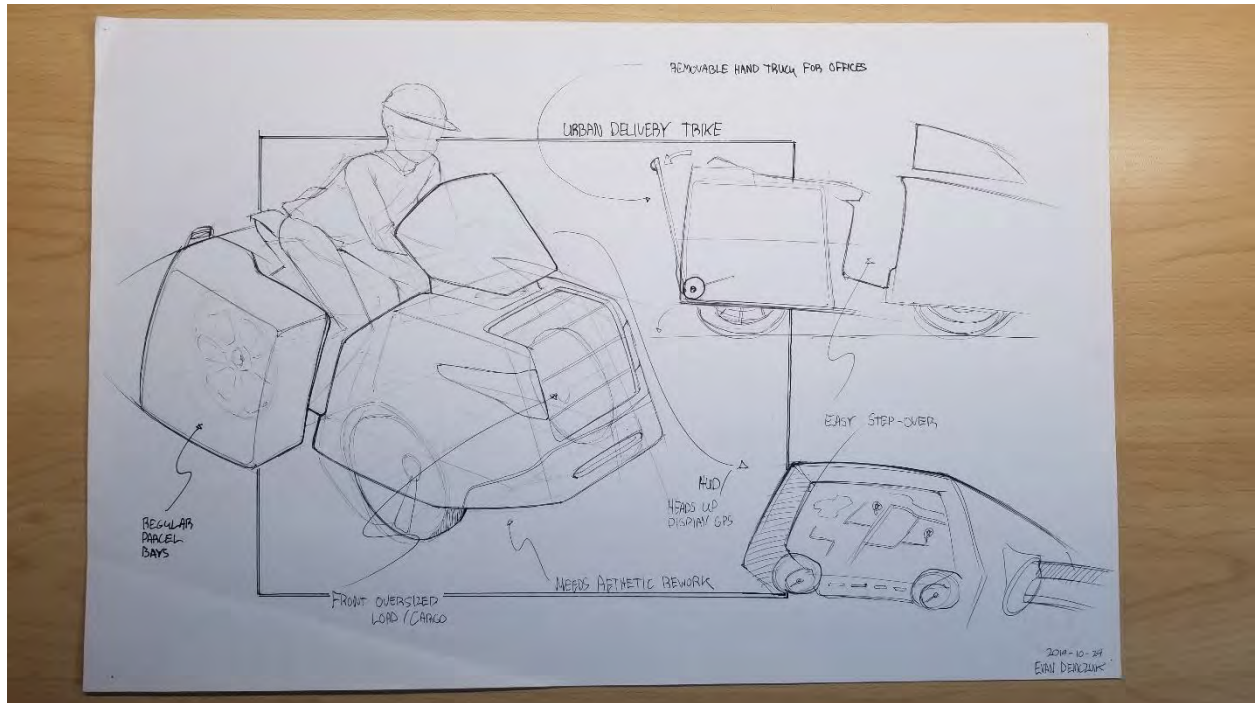
Inspiration Board

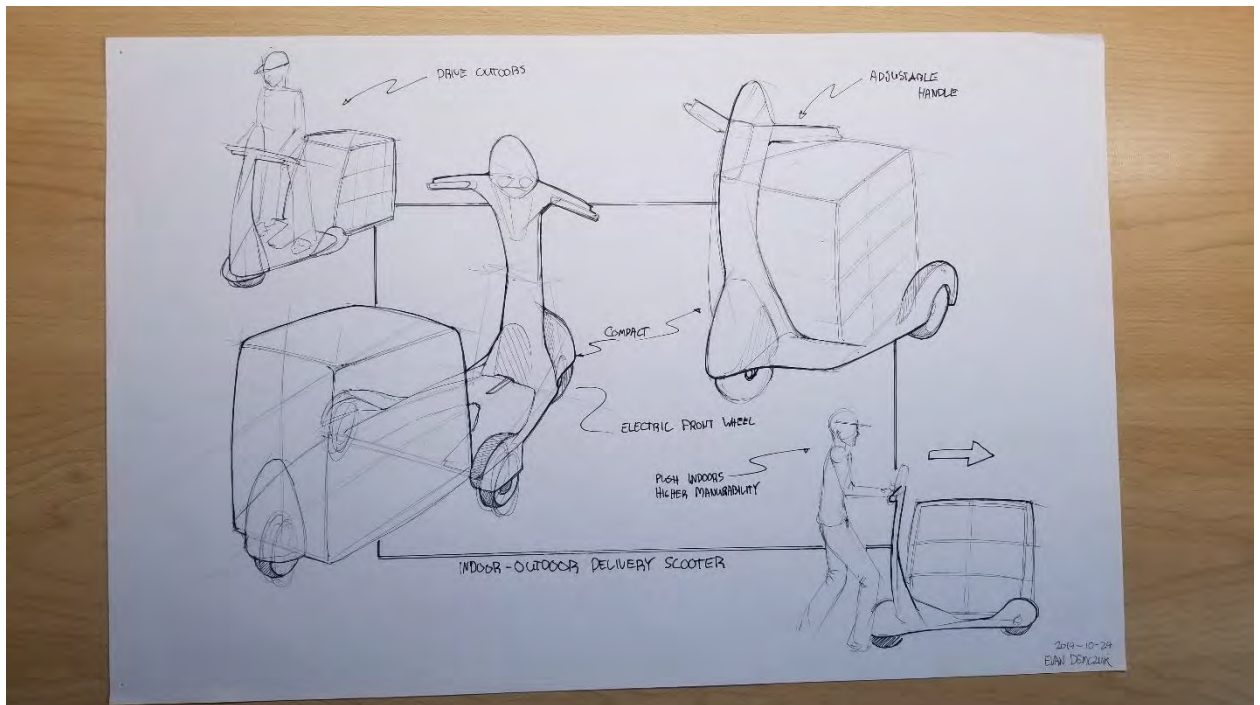
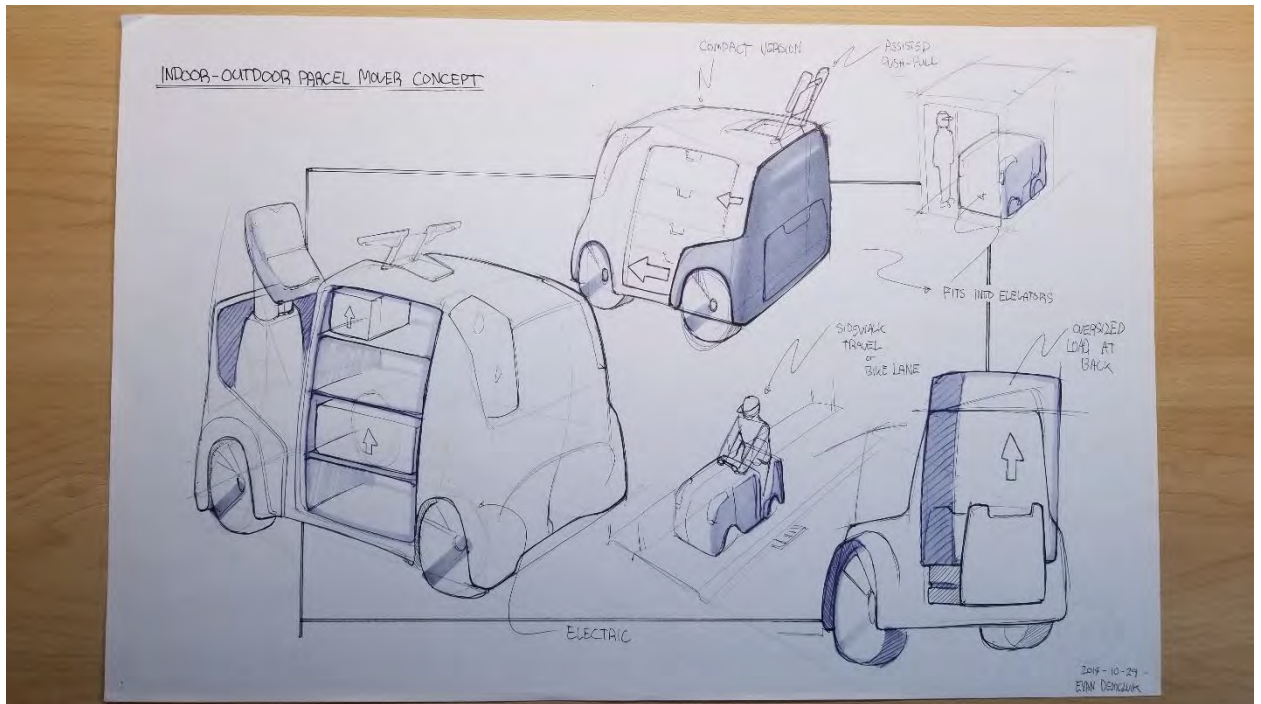


4.2 Preliminary Concept Exploration

Early exploration of ideas focused on a variety of profiles and functions to accomplish tasks along specific stages of delivery in various niches of the urban terrain. The goal was to find 2 configurations to develop into refined concepts.



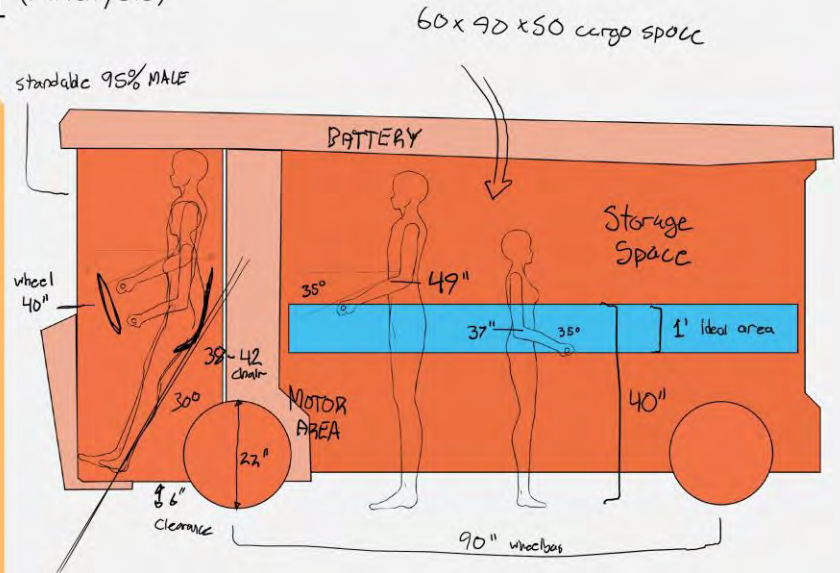




These were initial configurations drawn to give general shape and dimensions to serve two different functions for the final product. They were the result of the preceding sketches to ideate.

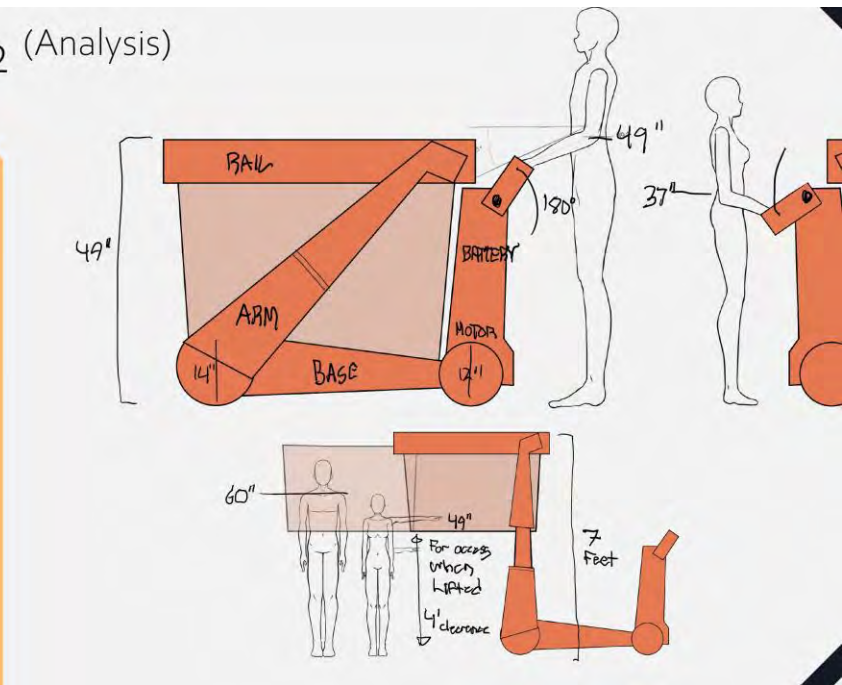
Configuration 1 (Analysis)

- 4 Wheeled Vehicle
 - Stability + Payload
 - 4 wheel steering
 - Boxy to maximize space
 - Integrate sleek lines for motion / urban integration
 - Electric motor / AI potential
 - Seats 1 person
 - Semi-standing or seated
 - Variable storage space
 - Rising/lowering shelving
 - Spaces for different sizes
 - More accessible space the easier to organize
 - Accessible at ideal level
 - Small wheel base
 - Compact form
 - Front loading



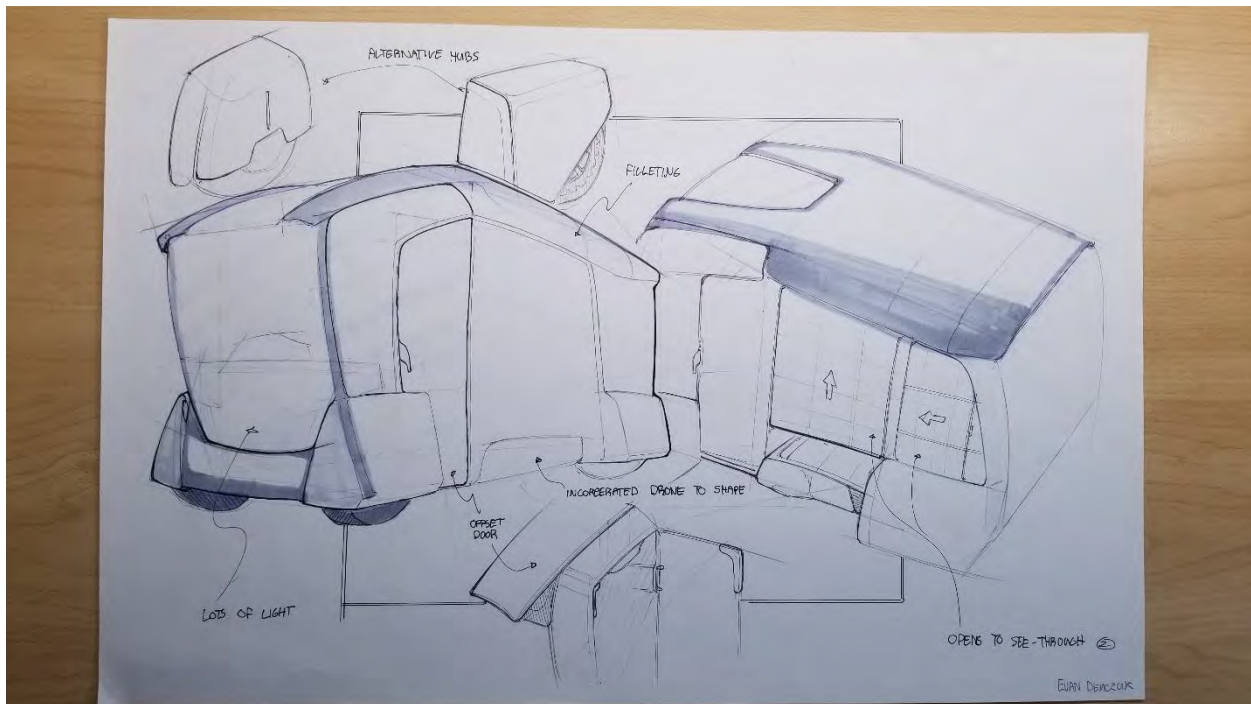
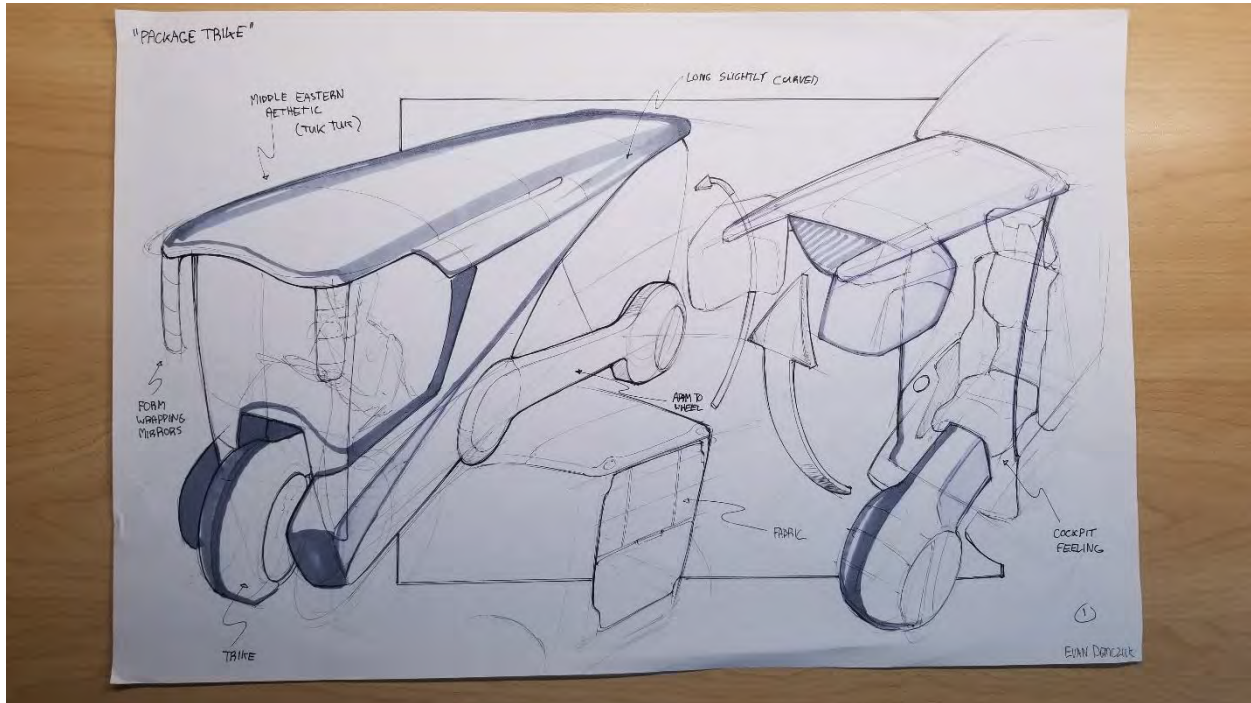
Configuration 2 (Analysis)

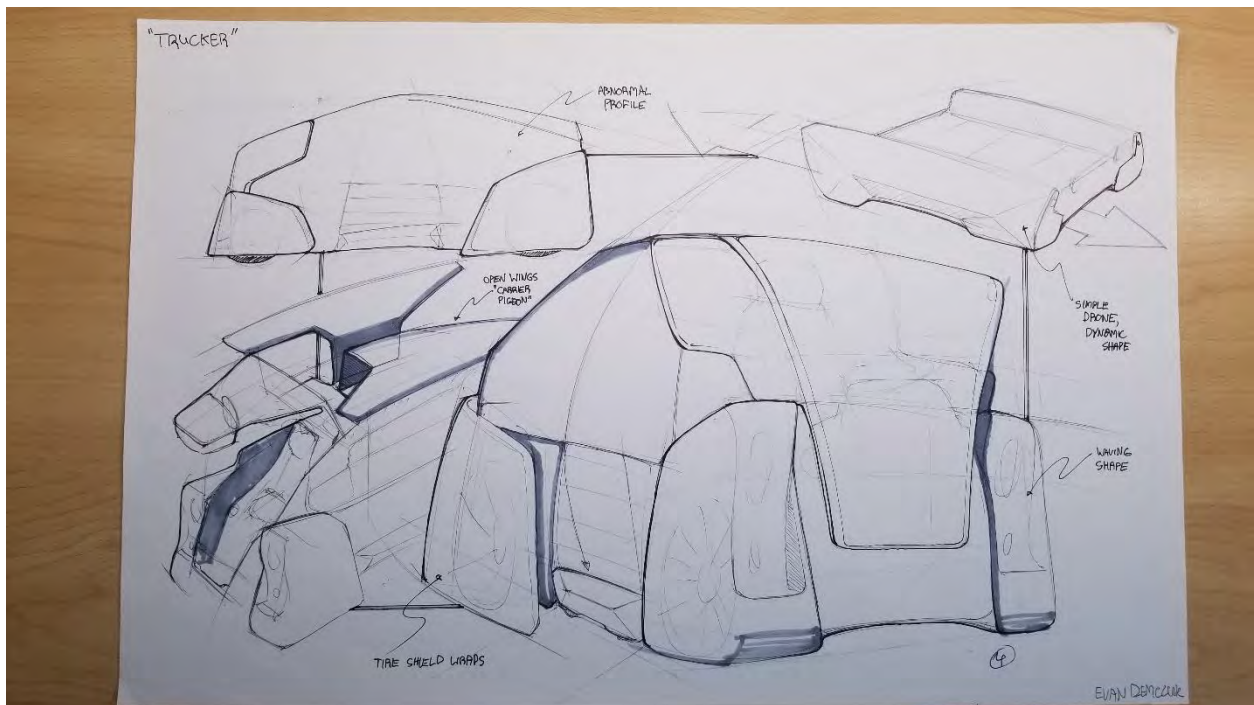
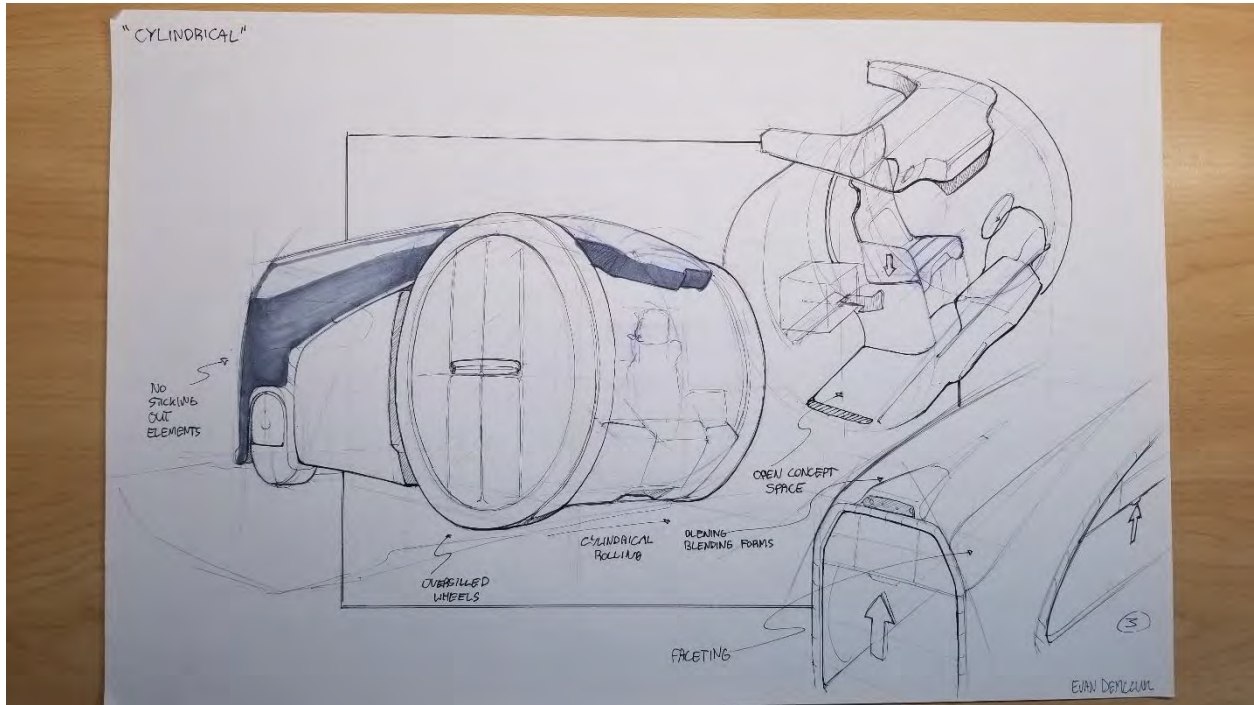
- Container + Lifter
 - Container that is
 - Open concept
 - Access from any angle
 - Variable sizes
 - Modularity
 - Access at ideal level
 - Lifter that is
 - Visual clear
 - Able to stack in back of vehicle
 - Electric powered
 - Rotating Handle
 - Easy to maneuver
 - Small wheelbase
 - Rear powered steering
 - 4 wheel turning

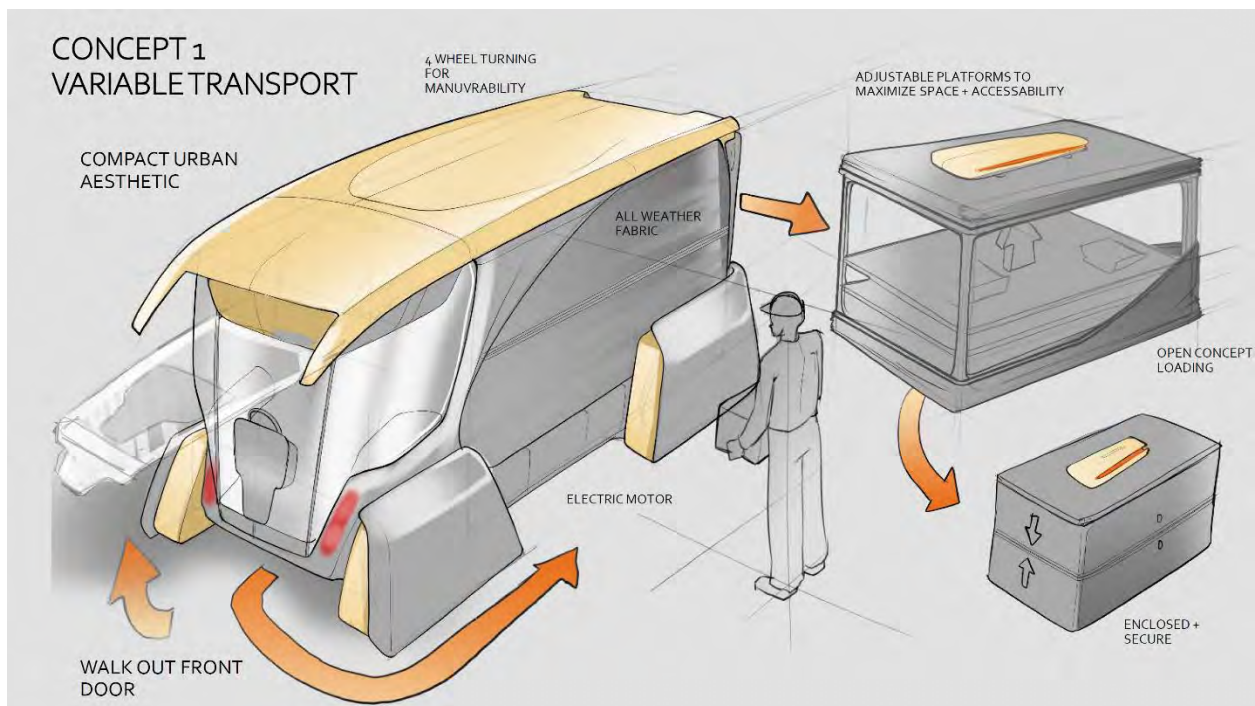
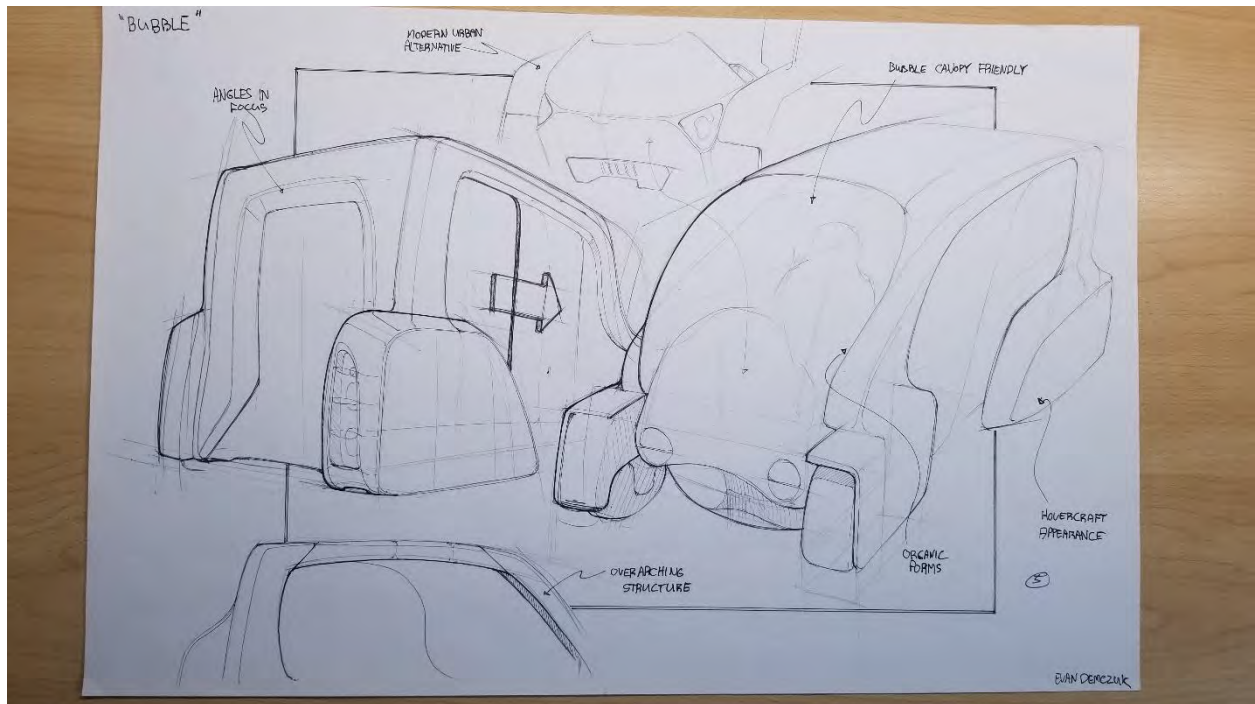


4.3 Concept Refinement

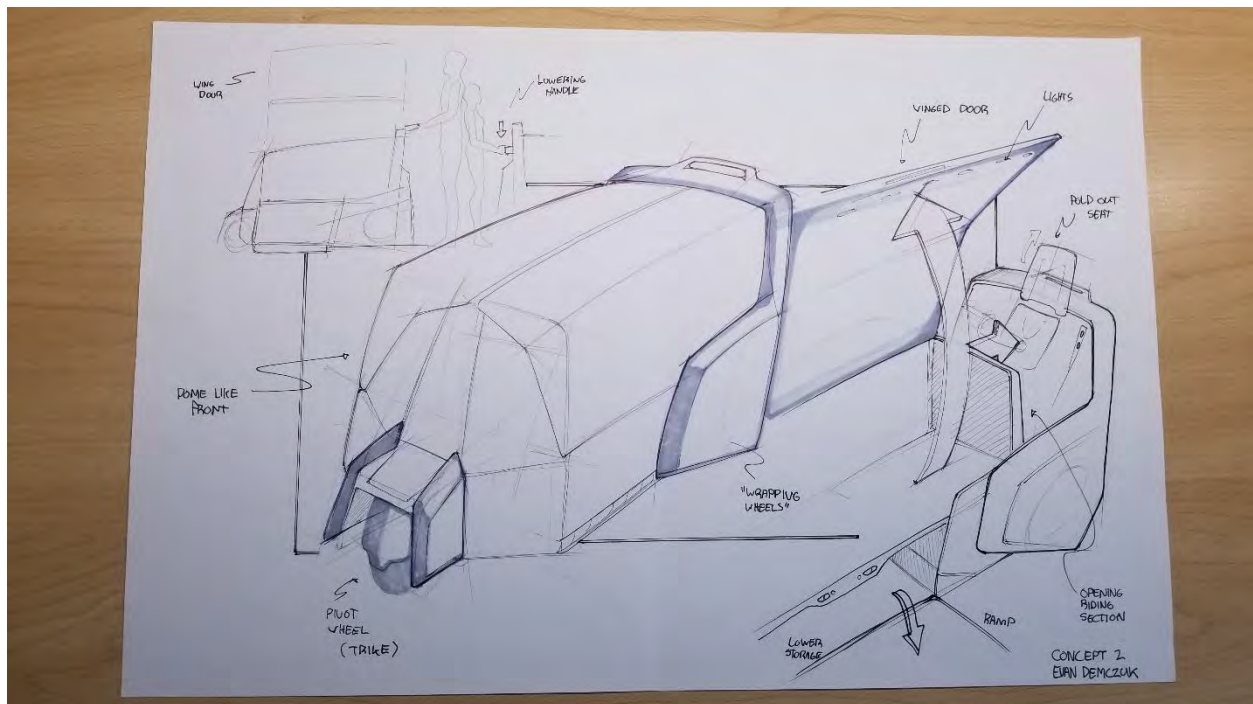
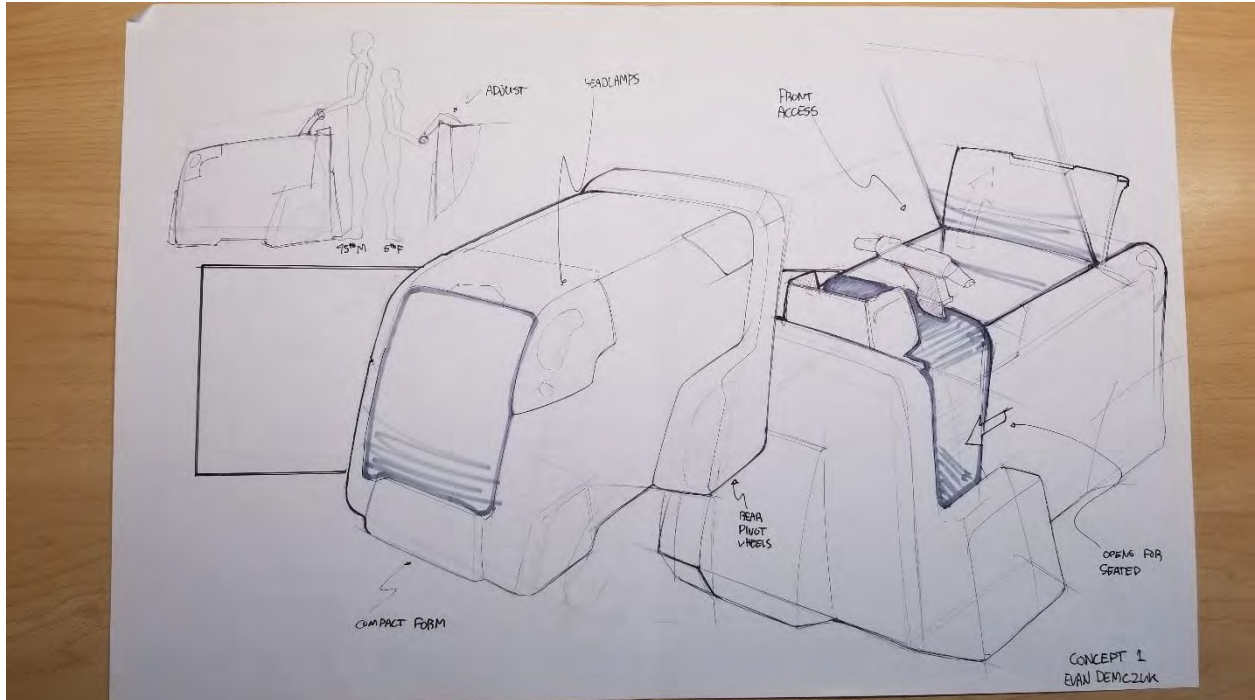
This first set of sketches expanded on the full-size road vehicle package and the various styles that could be undertaken with functions that drive the forms.

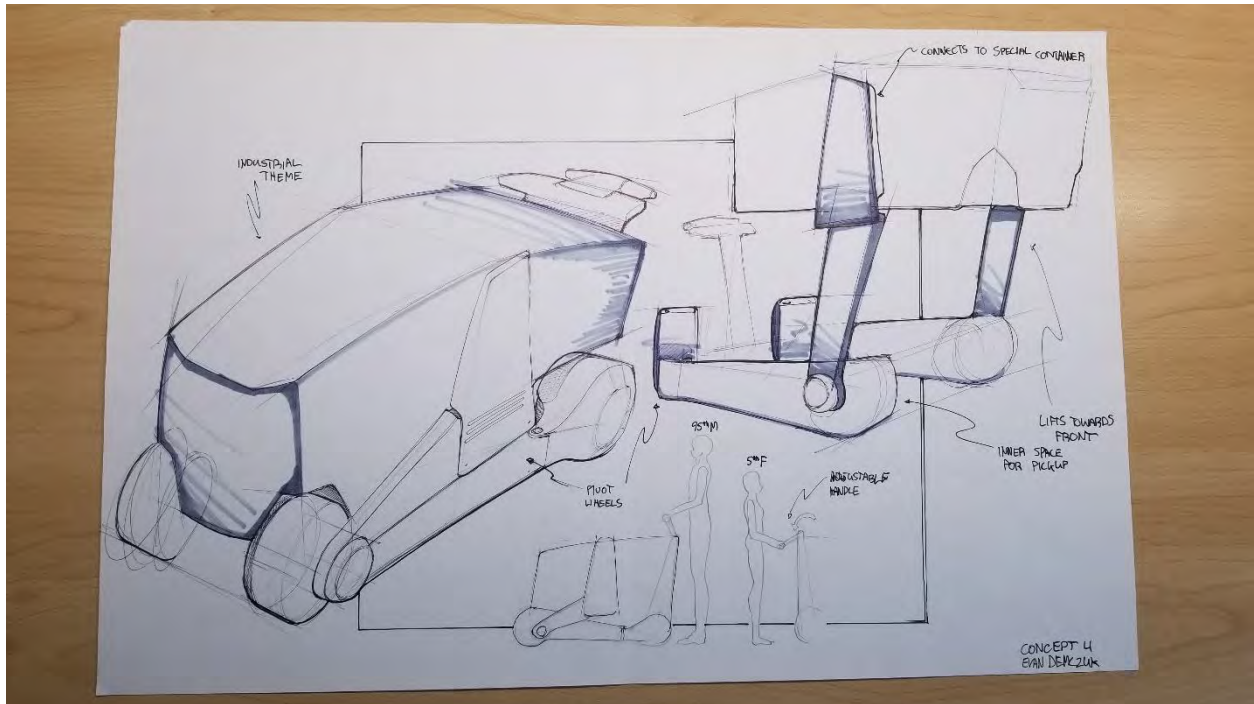
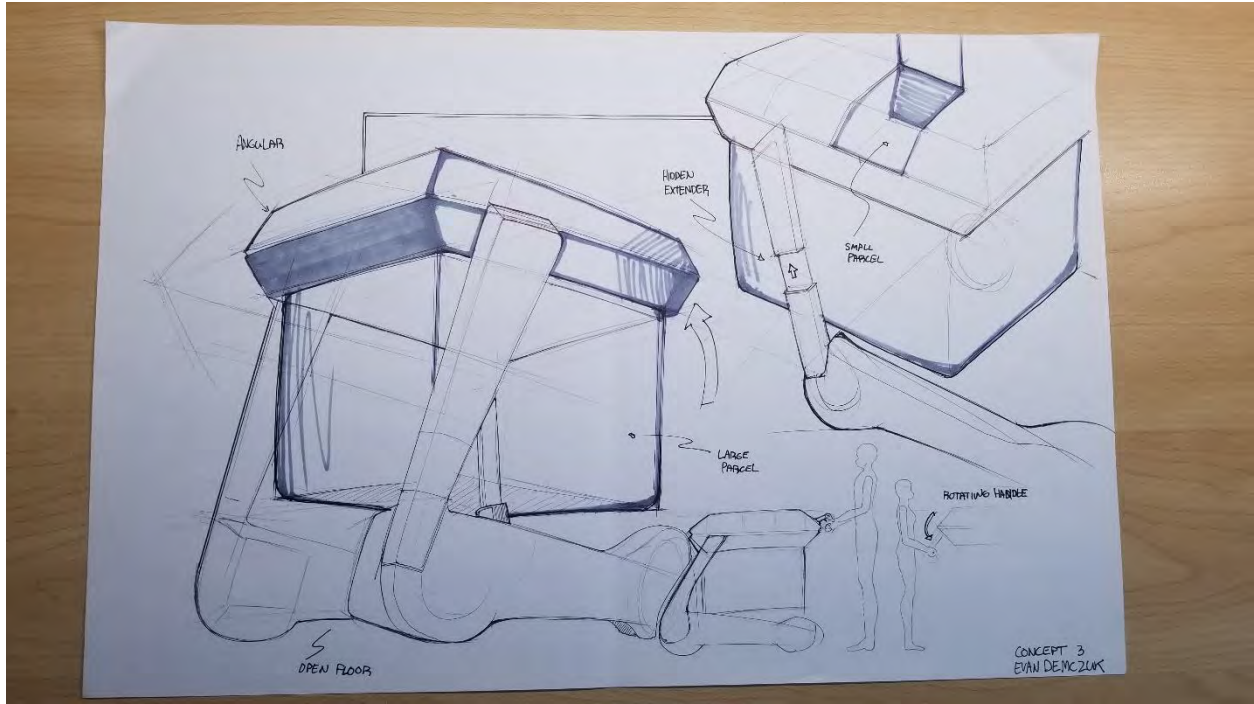


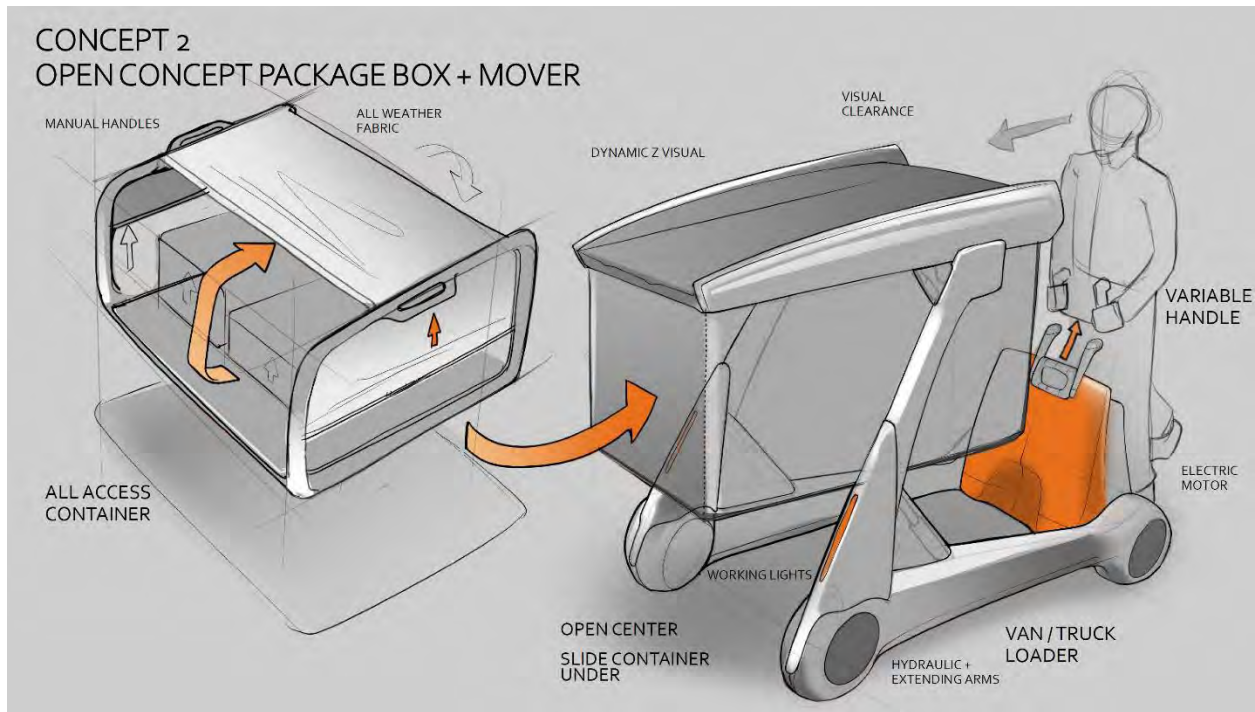
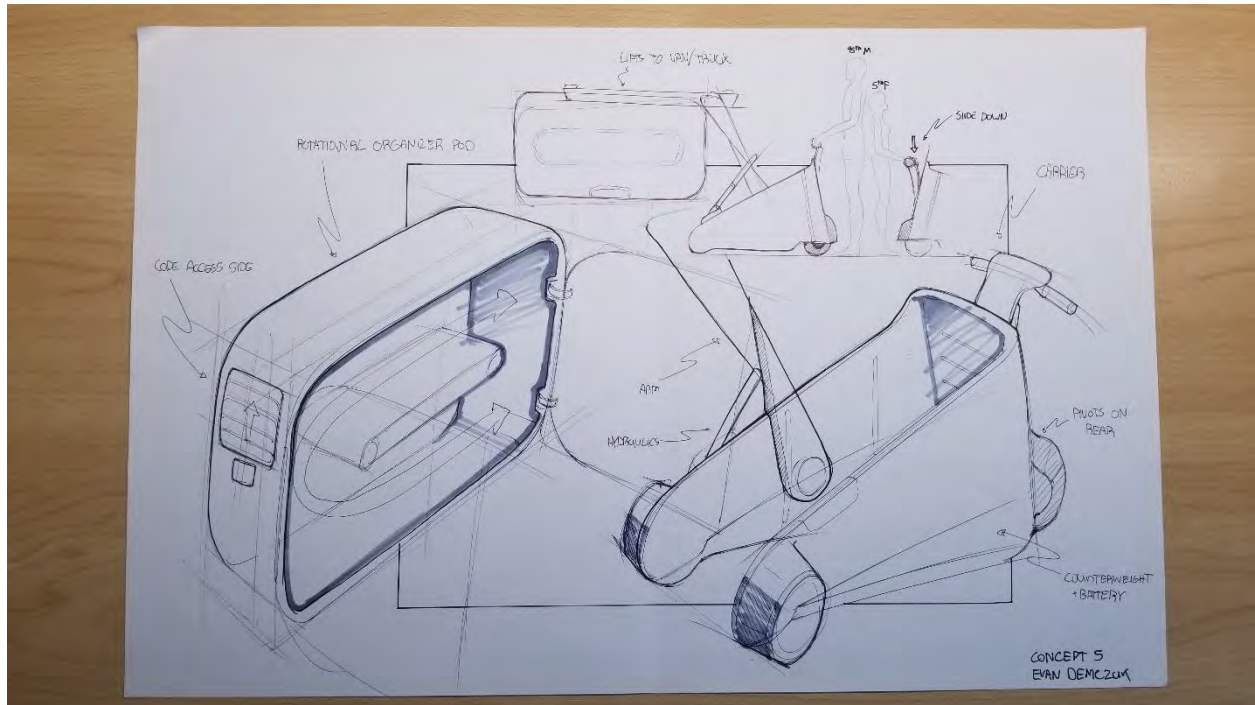


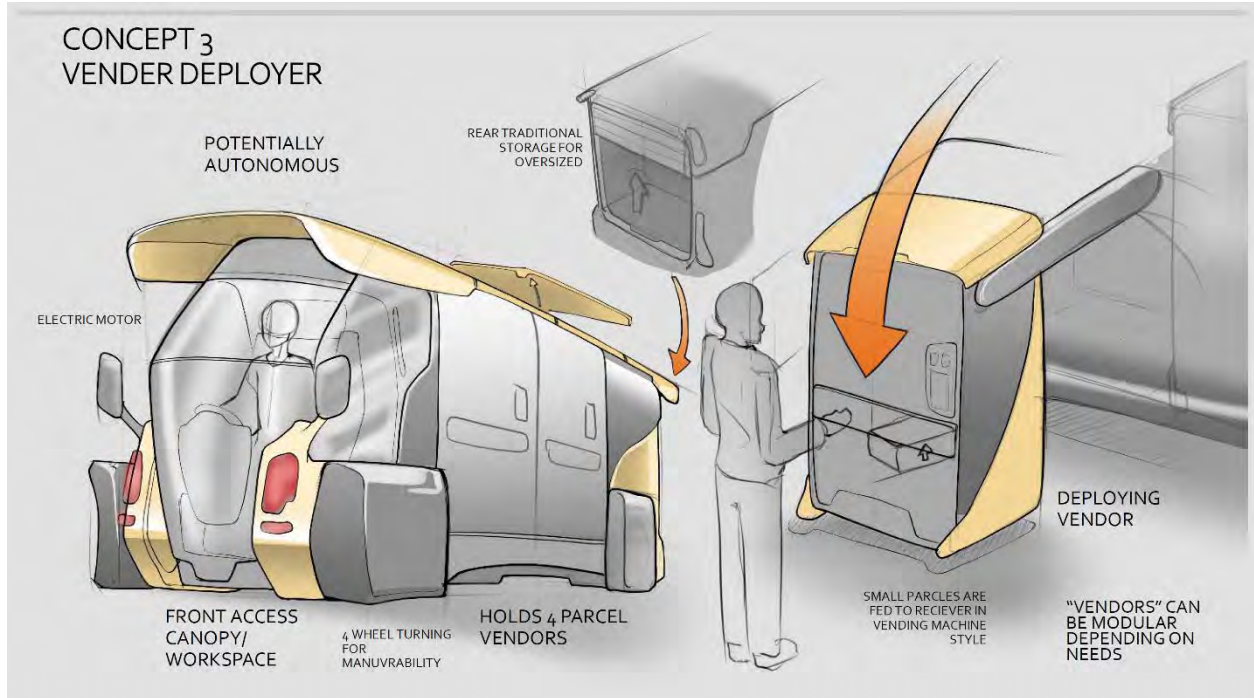


The following concepts were developed from the second direction that explore more sidewalk-oriented transports and narrow/indoor spaces. These had potential to be warehouse transports as well, and focused on smaller being extremely compact but with a high payload.





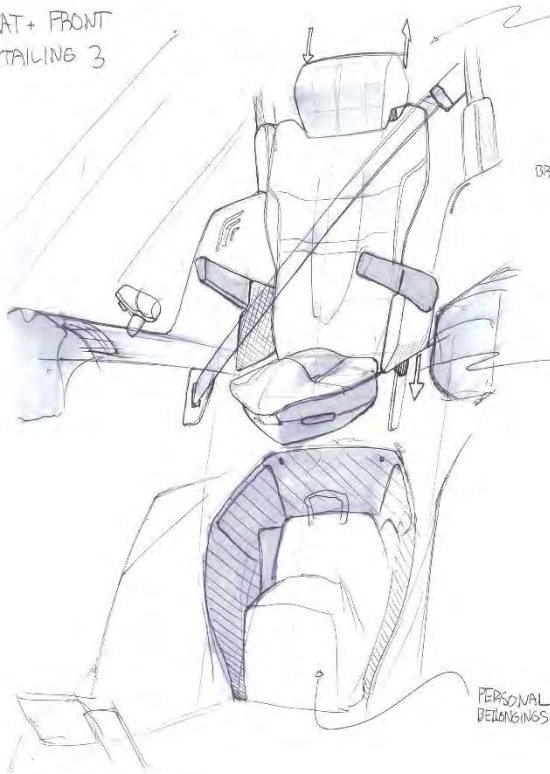




This final concept (3) was developed during the final mid-way proposal as a combination between both concept directions that utilized specialized parcel boxes that could be handled mechanically by the vehicle to take considerable physical work off of the deliverer. This was the chosen concept to develop into the product to solve the problem of urban parcel distribution.

4.4 Detail Resolution

SEAT + FRONT
DETAILING 3

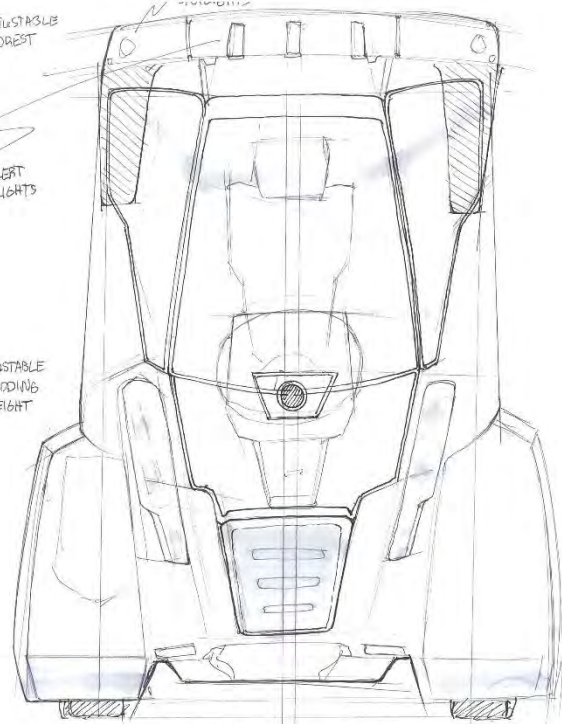


PERSONAL BELONGINGS

ADJUSTABLE HEADREST

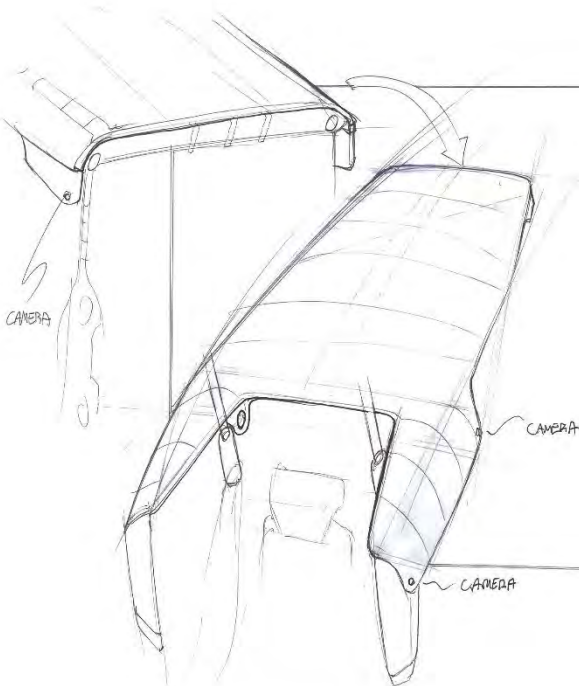
BRAKE/ALERT LIGHTS

ADJUSTABLE SEATING HEIGHT



FRONT VIEW

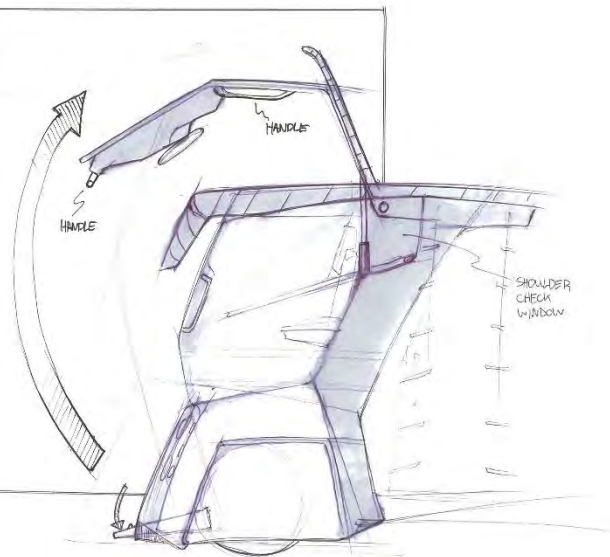
EVAN DEMCZUK



CAMERA

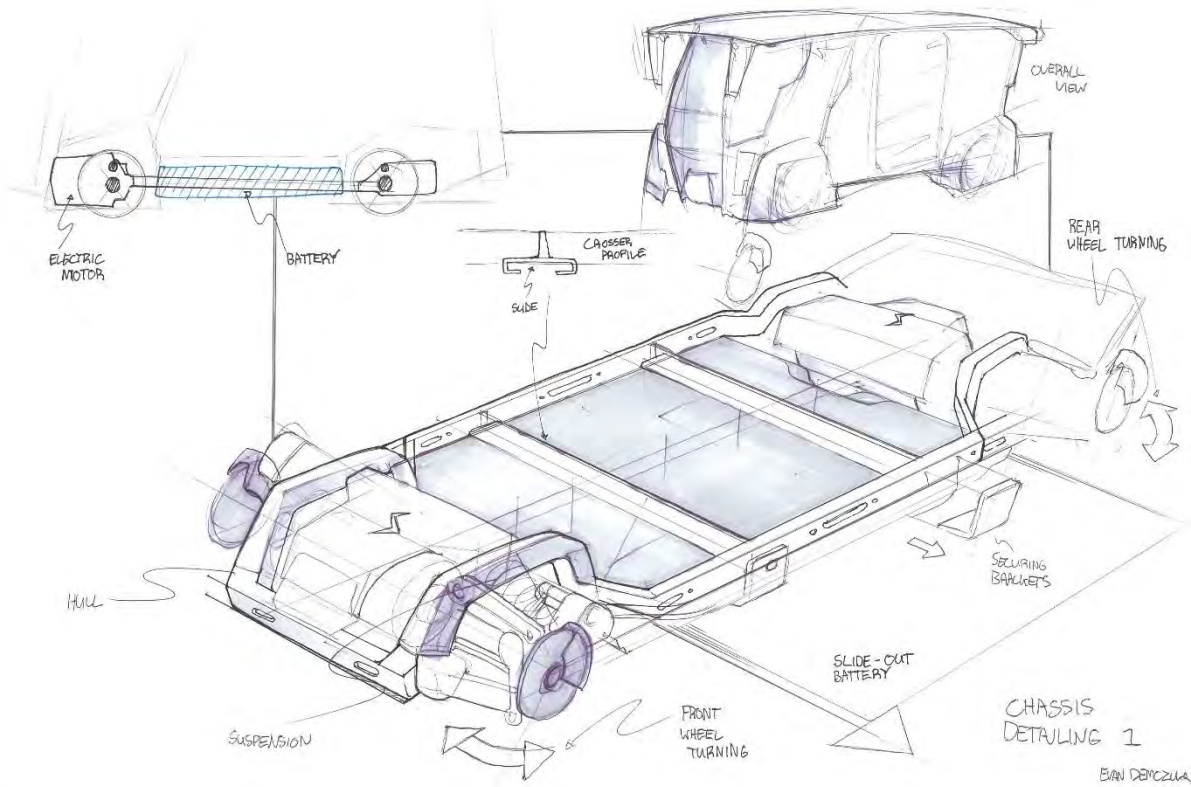
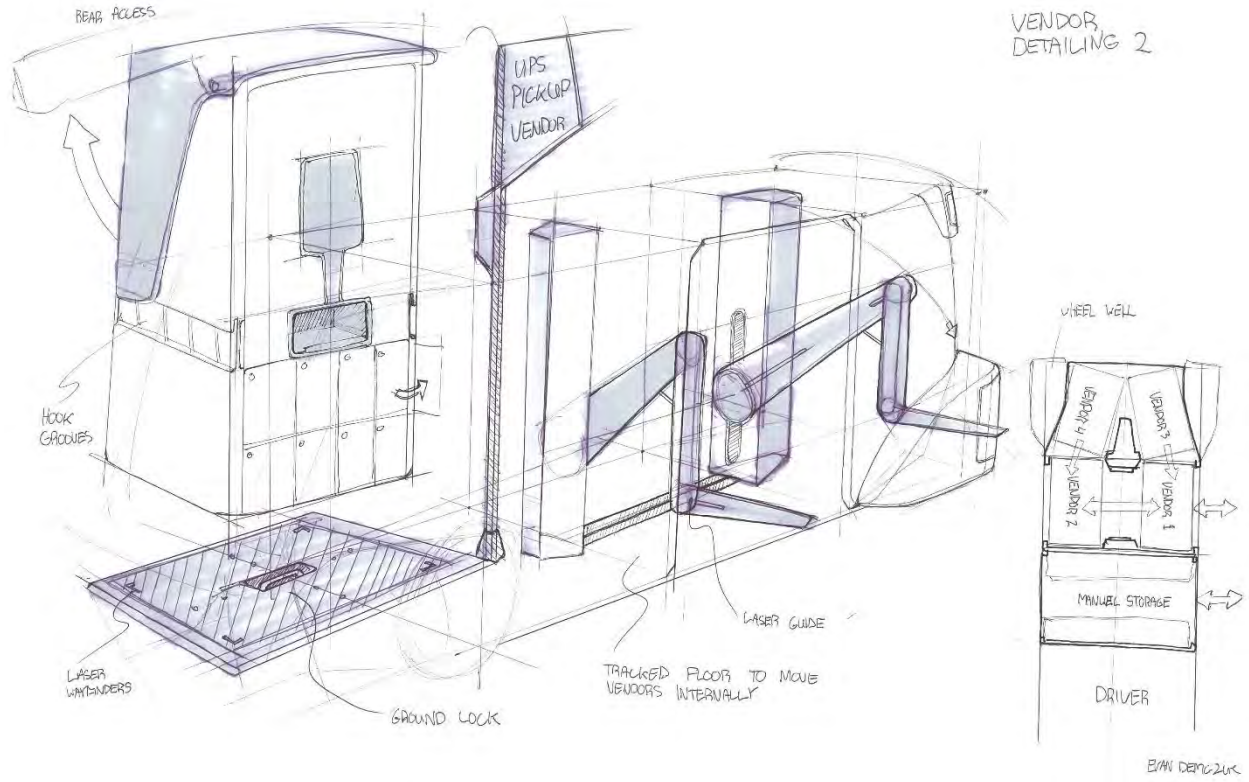
CAMERA

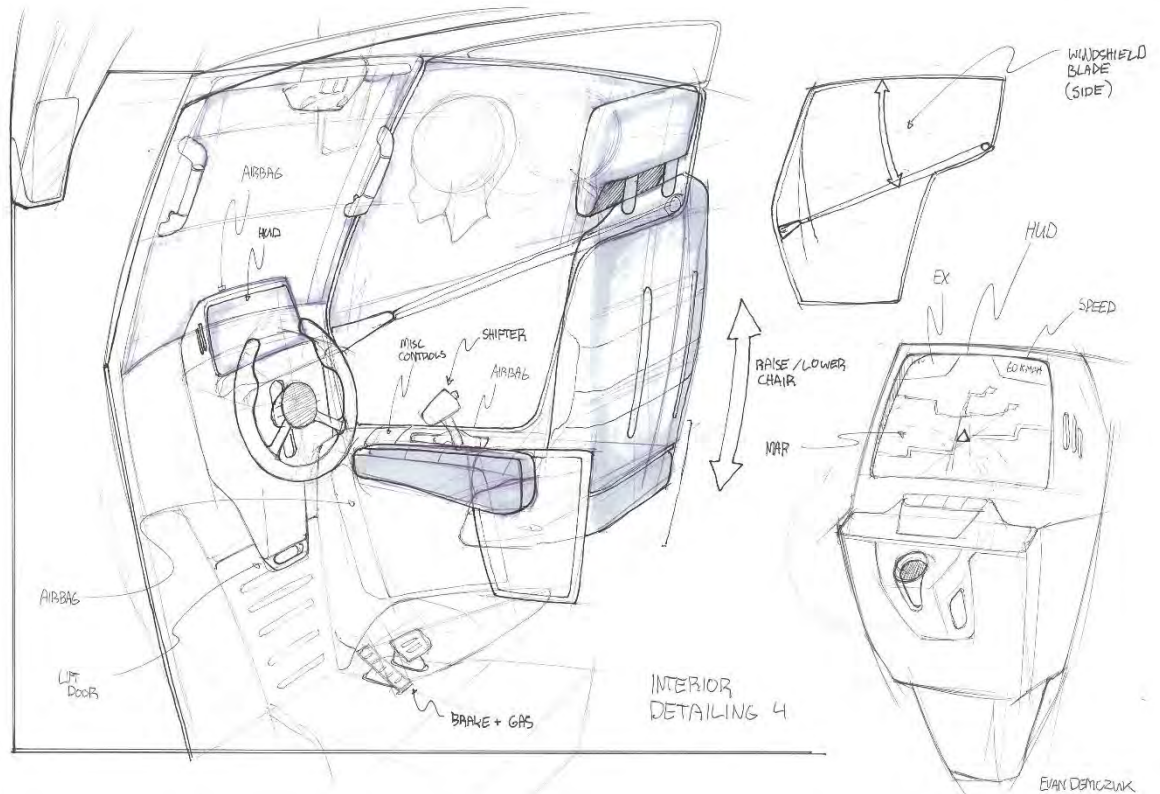
CAMERA



CANOPY
DETAILING 5

EVAN DEMCZUK

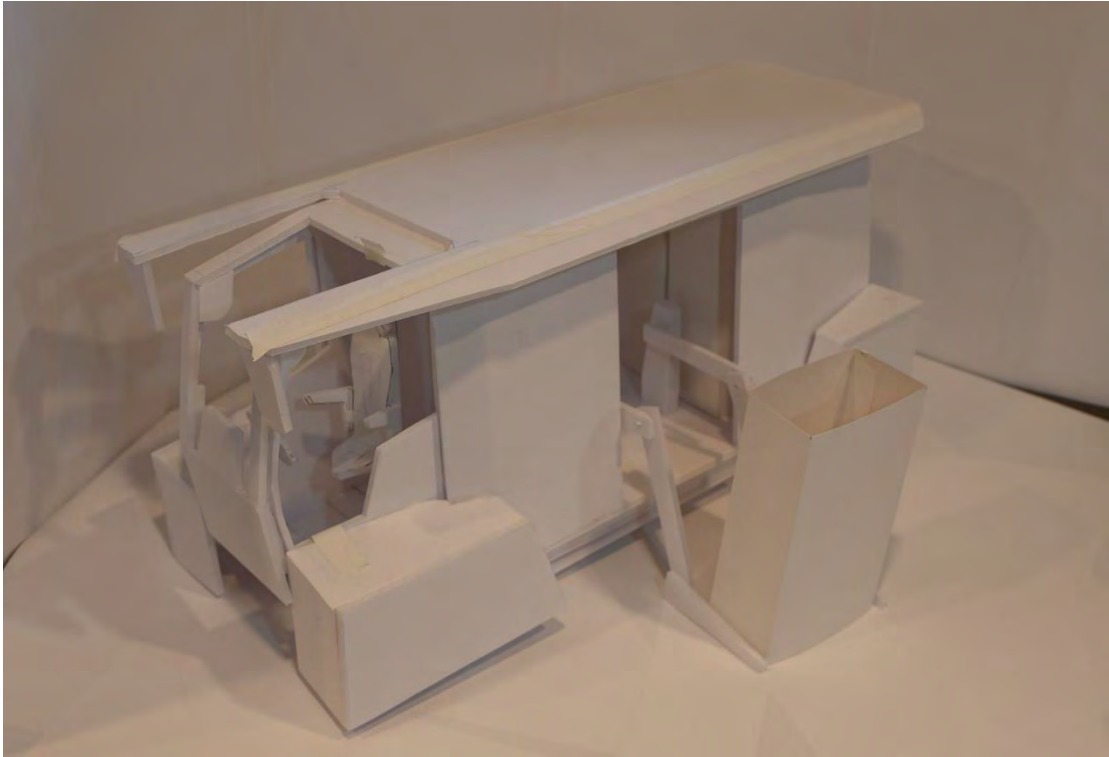




Pages here depict the final details for the direction chosen. The goal was to create a vehicle which had special functions to aid with delivery. There was a special focus on creating easy entry and exiting to the vehicle given circumstances the user might be in, and the development of a chair that has standing qualities to provide several benefits. To help load and unload the cargo bay it would be beneficial to use a mechanical arm to do the job of a forklift but compact and available to move large parcel lockers incapable of being moved by a person's physical strength. Explanations of choices and tweaks will be further explored in chapter 5.

4.5 Sketch Models

Functionality



Ergonomics



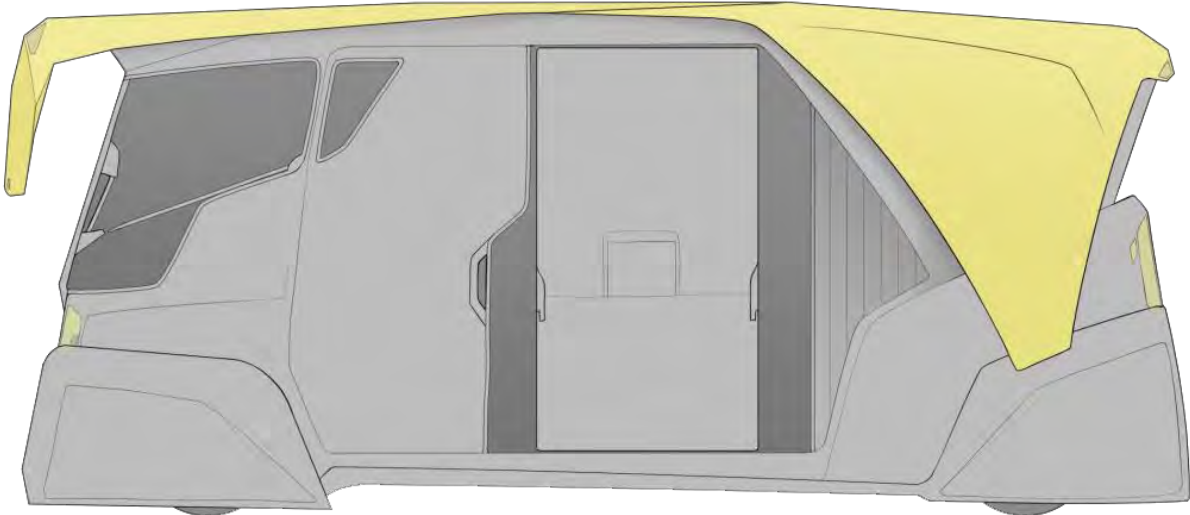
Ergonomic Buck (Lowered Seat Angle, Lowered Headrest)



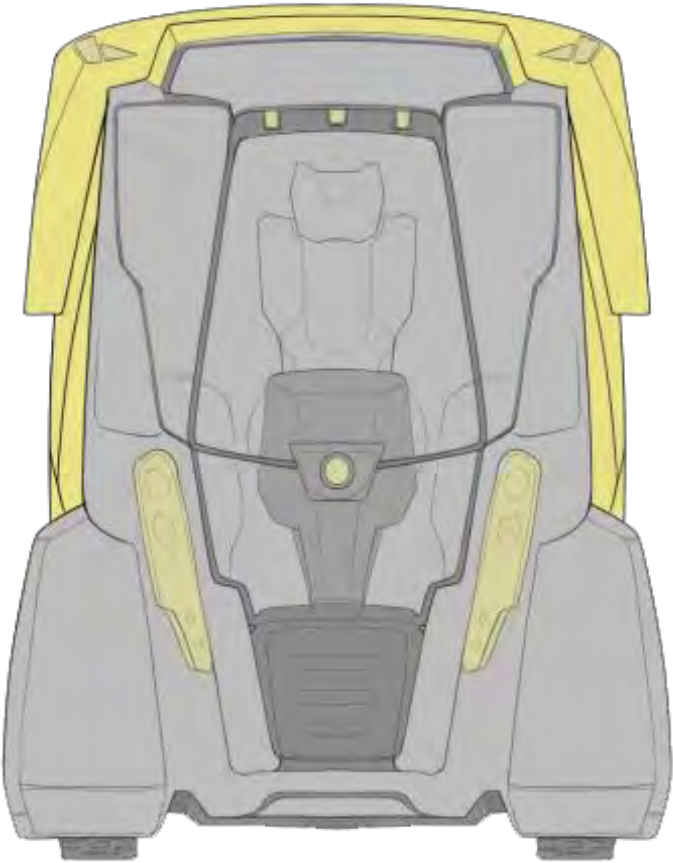
Ergonomic Buck (Low) with 5' 6" Male

A scale foam core model was used to get a sense of proportions and space available in the cargo bay while keeping it within the dimensions of currently fielded cargo vans on the road. It provided critical feedback on how the rear space could be organized. The ergonomic buck was created to experiment with a standing seat alternative for driving and received mixed feedback that was developed into a multi-position chair for different times of use.

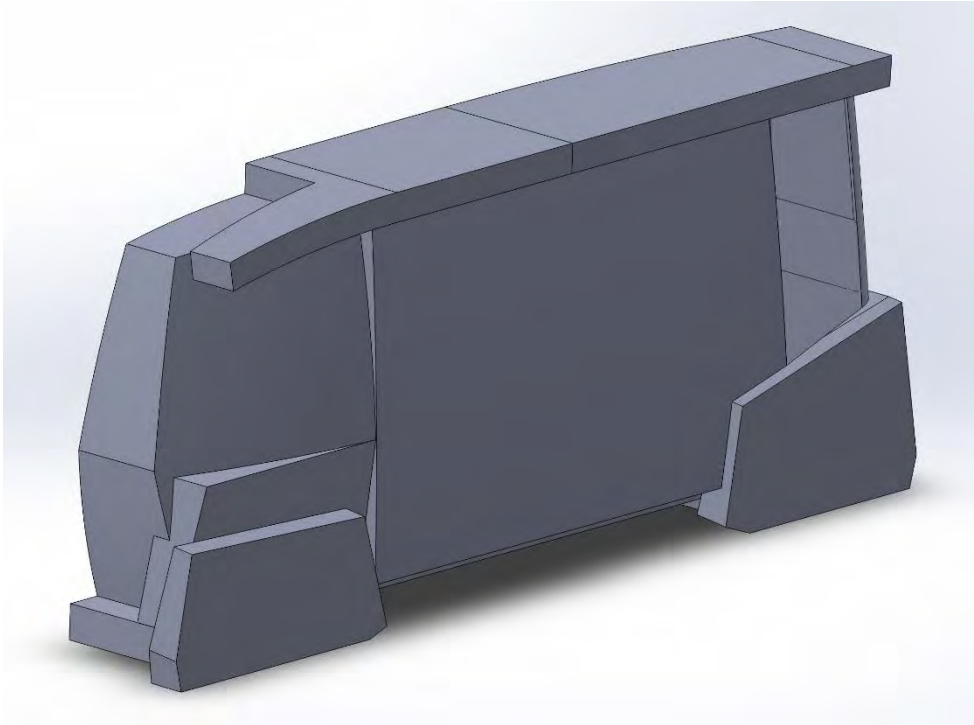
4.6 Final Design



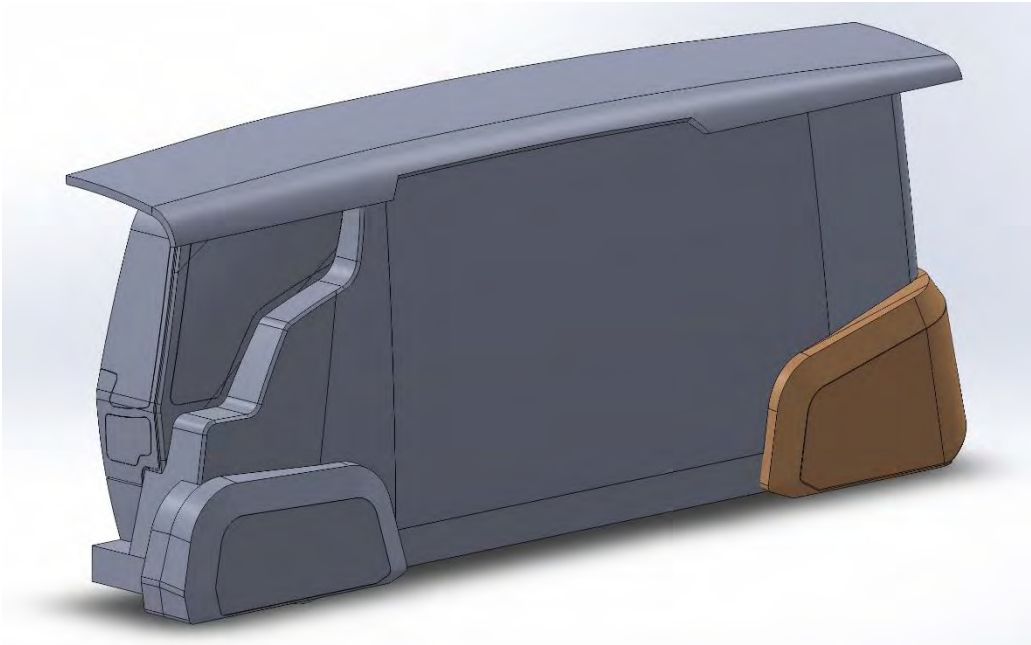
These final profile drawings were the aesthetic chosen to develop in CAD work. It features rounded surfacing and a large canopy roof with extending protrusions that follow the shape.



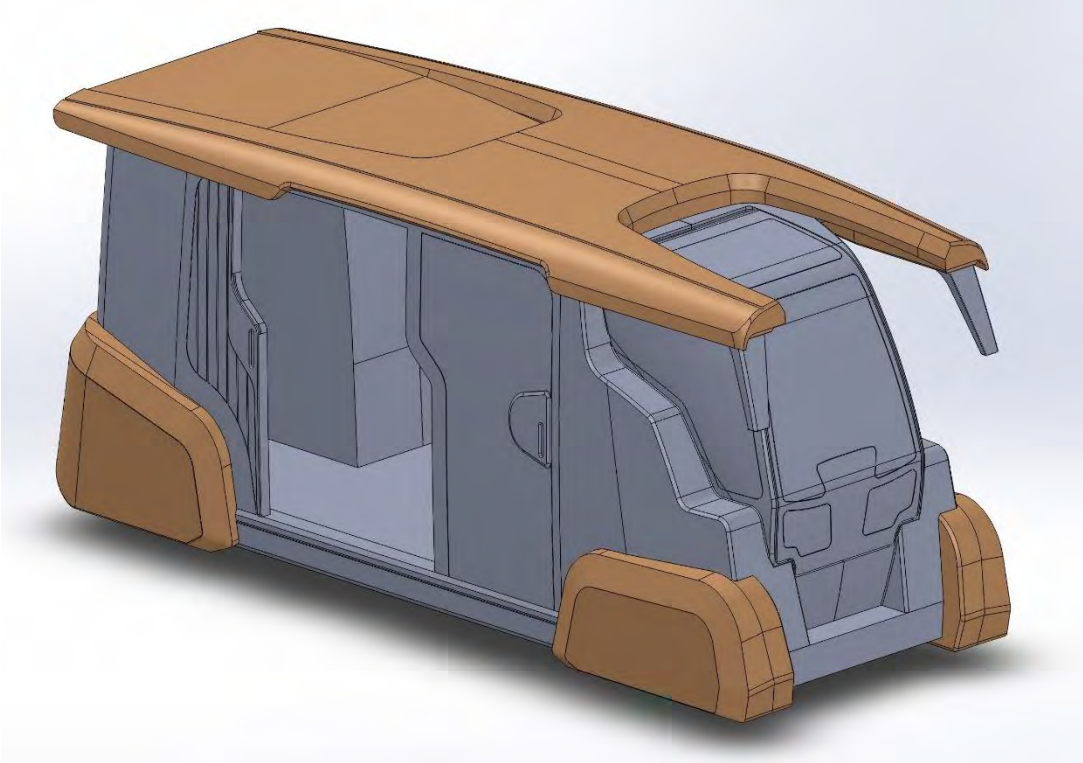
4.7 CAD Models



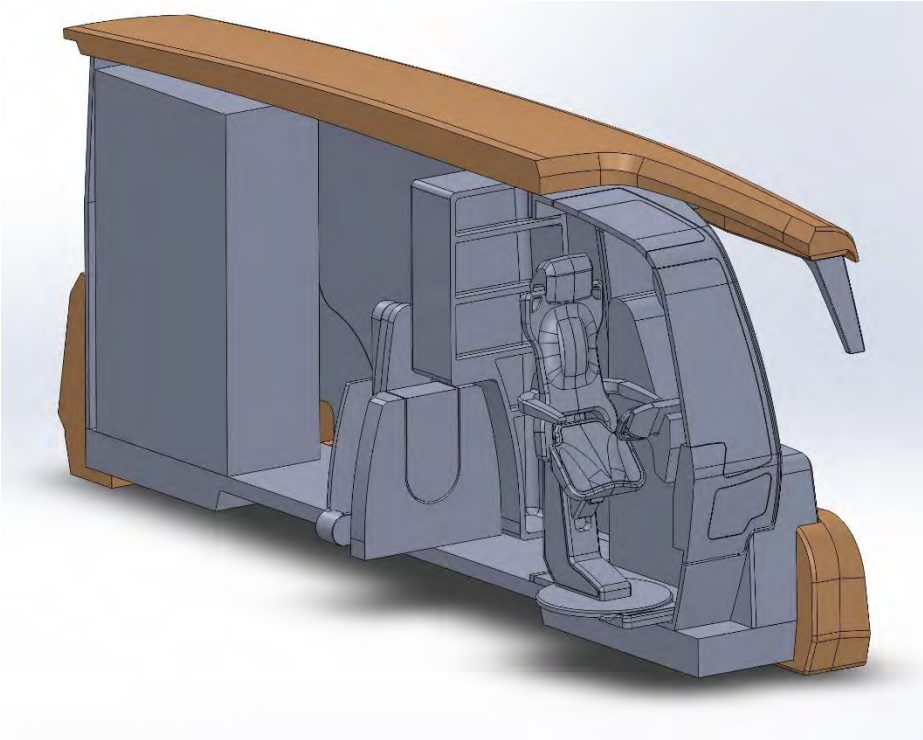
Initial forms to develop the body up. Done in scale for 3D printing.



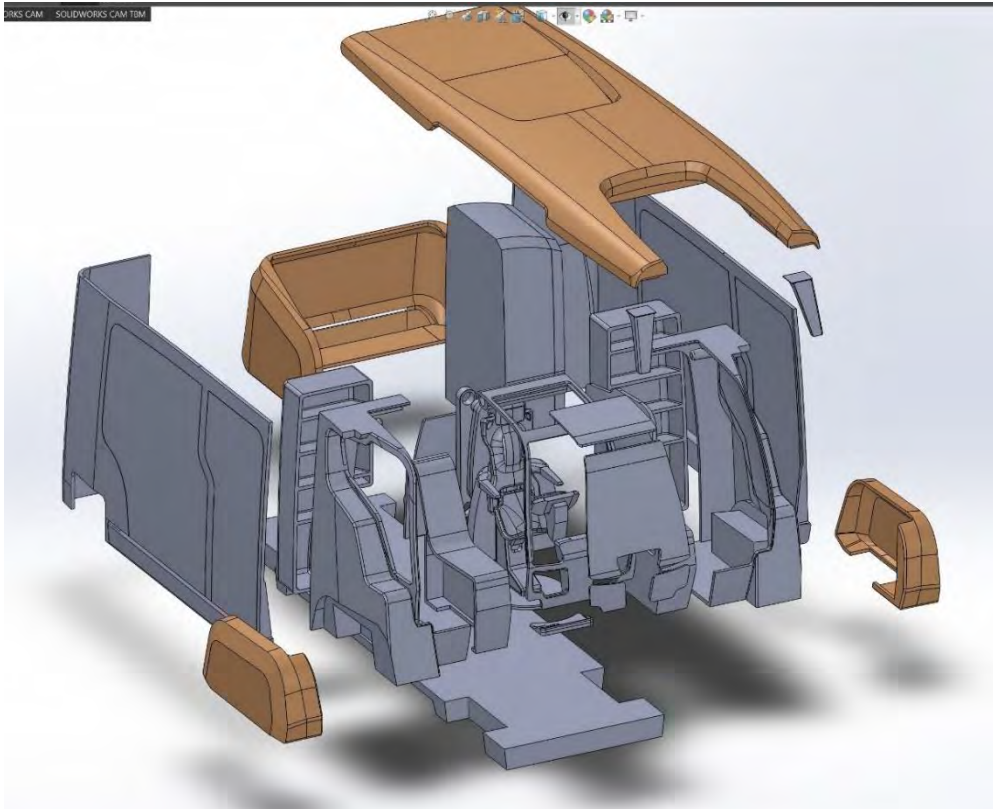
Smoothing out forms to create desired faceting.



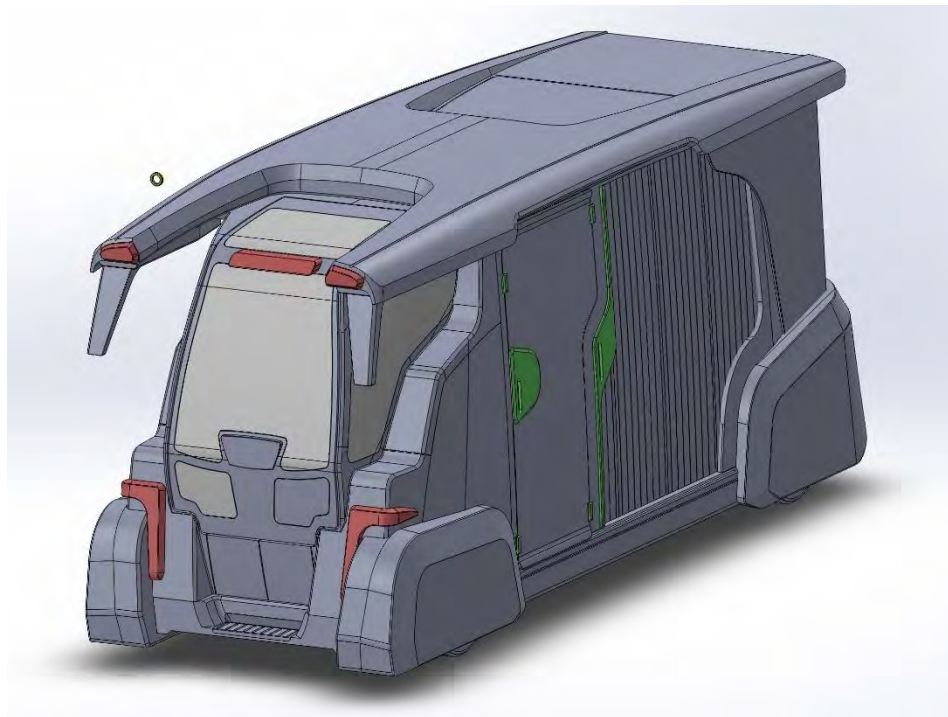
Detail Development and reflection of parts.



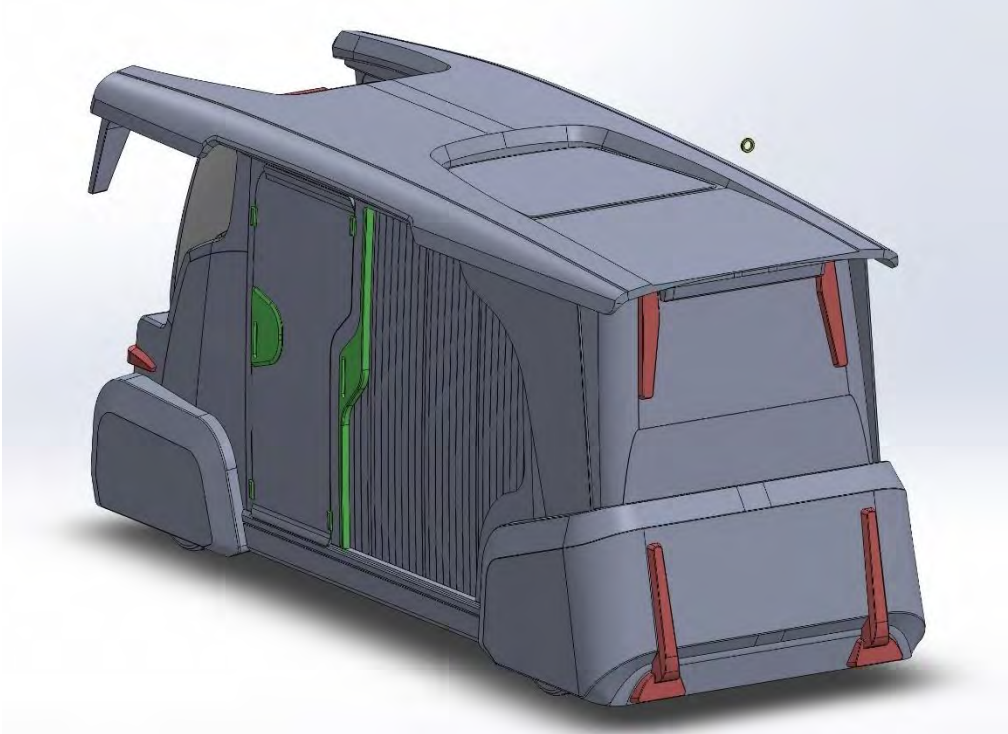
Internal additions and space organizing.



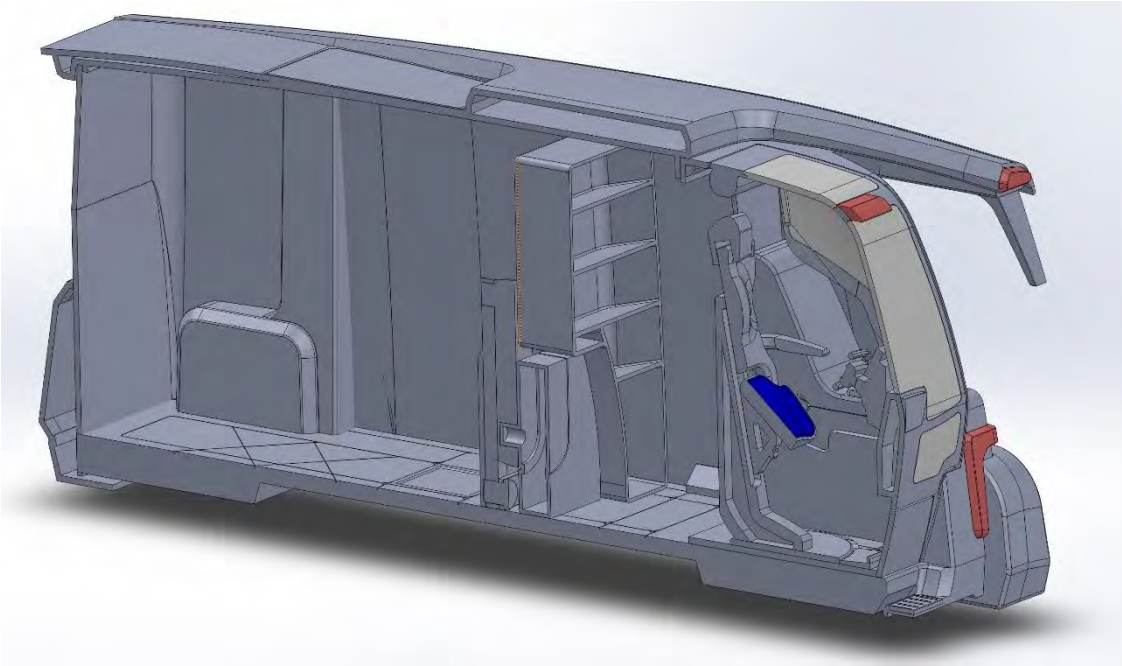
Exploded view of printable components for the final model. The roof and base were hand fabricated to save costs.



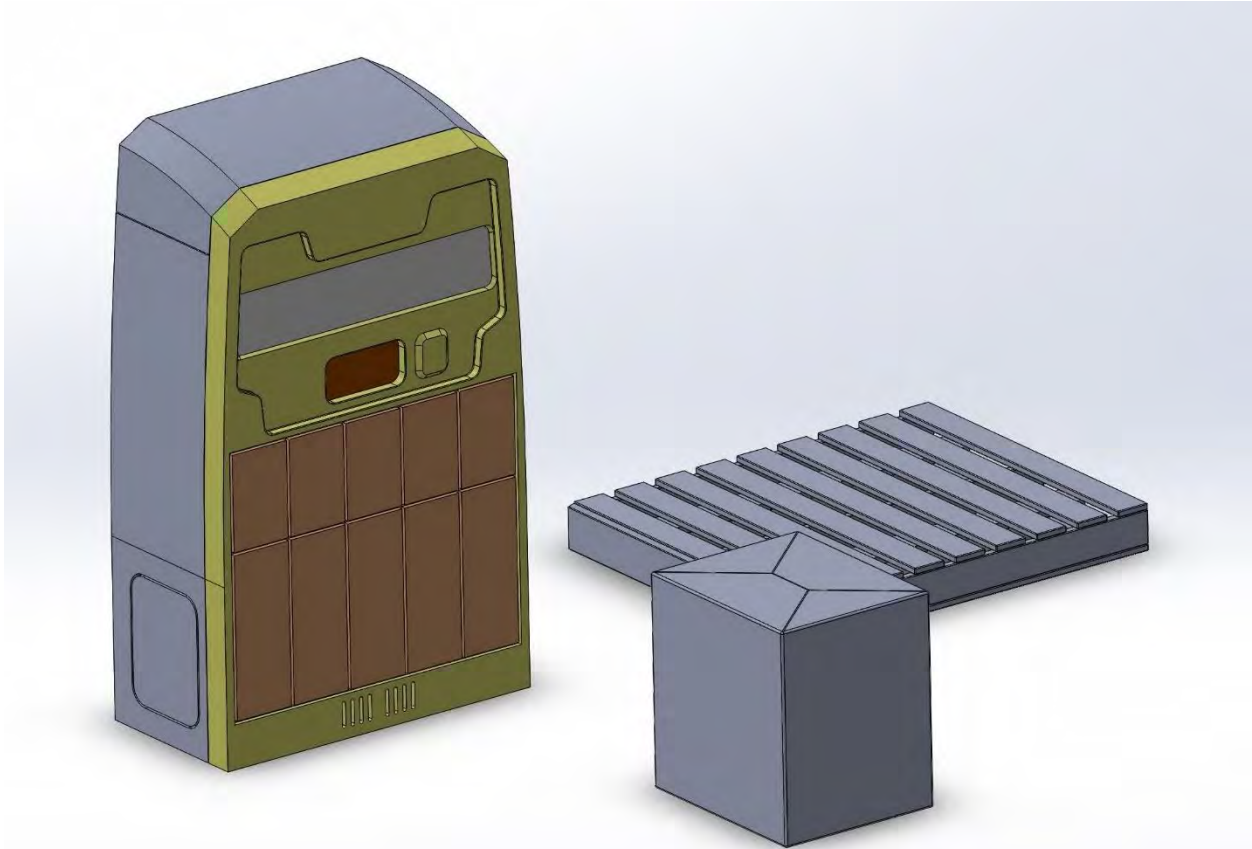
Scaled up and details added for final renderings and proper size checks.



Rear view of detailed CAD model in full scale.

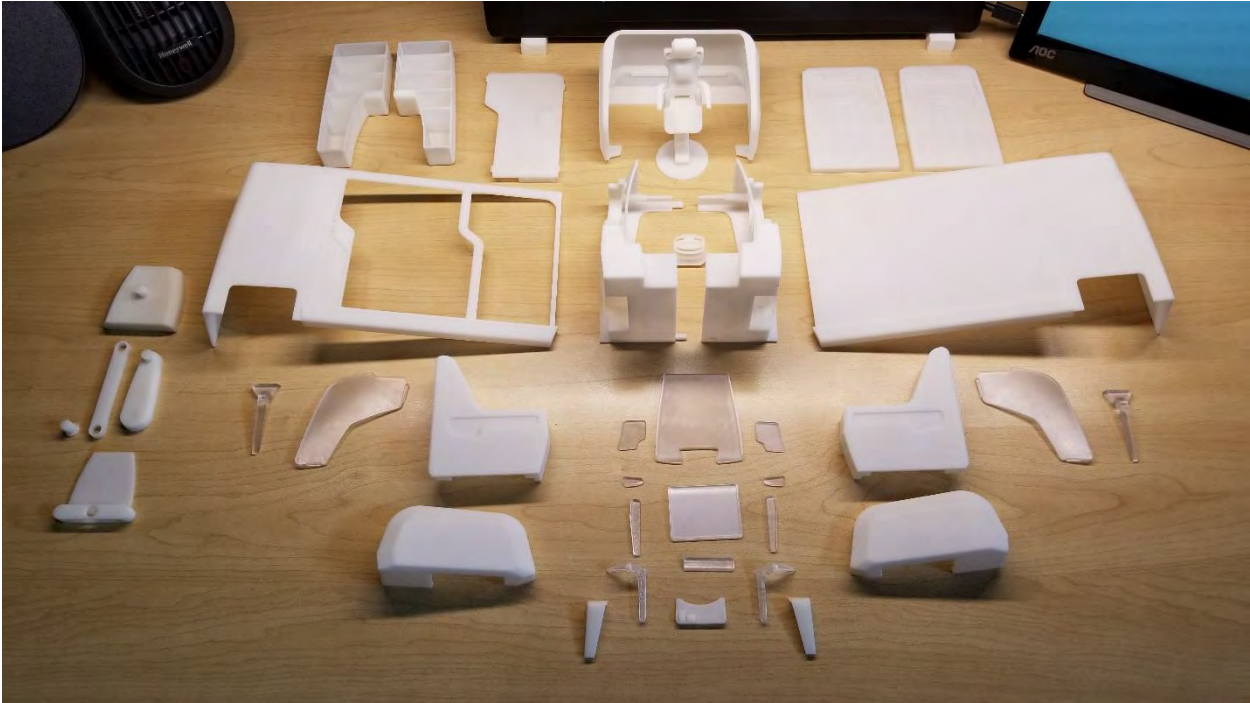


Internal view of detailed CAD model in full scale.



Parcel vending machine example. The vehicle can fit 4 under normal circumstances and up to 6. A 40"x48" pallet for scale was also created. A special insert could be attached to allow the installed arm in the vehicle to pick up and transport 2 pallets in place of parcel vending machines or other storage mediums.

4.8 Hard Model Fabrication History



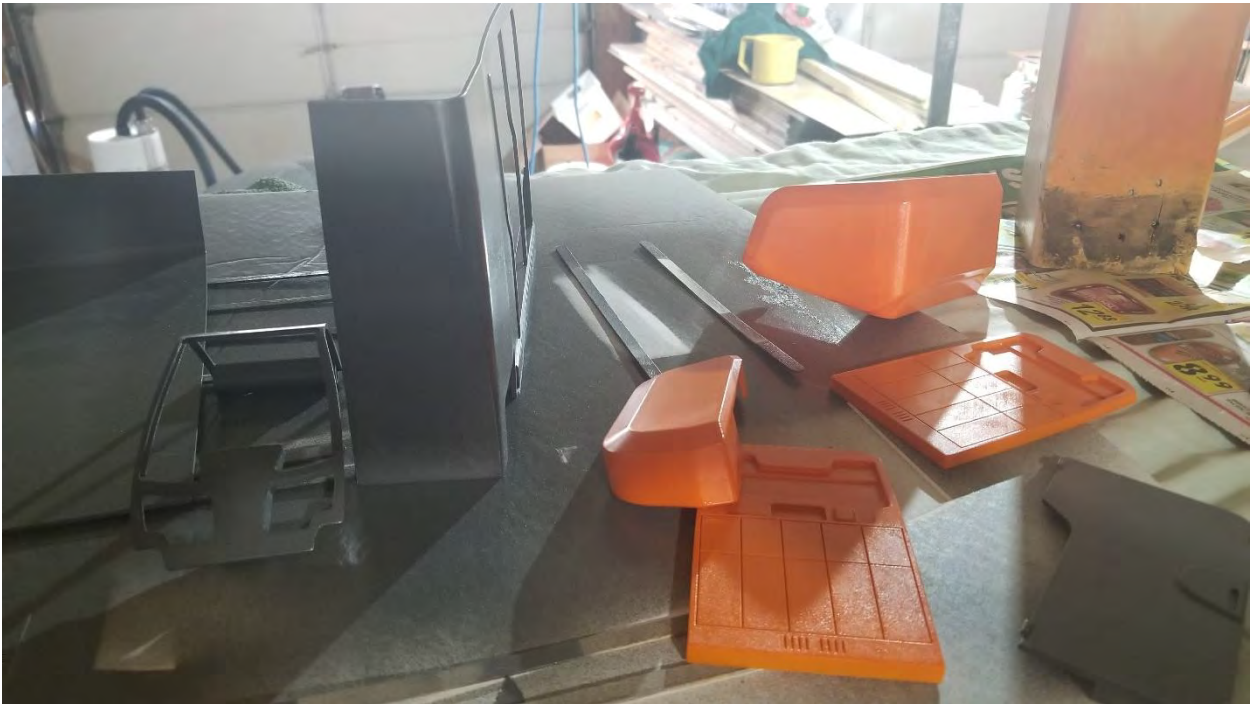
3D printed parts courtesy of Agile Manufacturing at a reduced price.



Dry fit of 3D printed parts.



Primer layer on parts.



Spray painting of various parts.



Hand fabricated roof piece out of laminated MDF. Original plan was to CNC from Renshape however due to Covid-19 and time restrictions it was the resorted plan.

CHAPTER 5 - FINAL DESIGN

This chapter will showcase and explain the logic behind the final design and the choices made to solve the problem of metropolitan parcel distribution. Renders will primarily show the design from multiple angles. It will also verify the design criteria set by professors and research to prove a successful concept of a product.

5.1 Summary



Description

The final name for the design was called “CONSIGN” for its ability to take on the task of sending anything to anybody. Designed for intracity parcel delivery to aid the ever-growing online shopping industry, CONSIGN is a van-class automotive transport with a primary feature to deploy “Parcel Lockers” around the city to reduce active time or compound deliveries made in a shift. Its unique form and color bring a splash to the urban core while retaining a metropolitan industrial look. Outfitted with a unique driver’s cabin to save space and rotate, this lean-to seat makes it easier to enter and exit the vehicle for manual handoff of packages where parcel lockers aren’t an option. A lifting arm helps load heavy boxes quickly with laser-guided precision for LIDAR sensors that double as security features. A well-lit under-roof provides light and notification to the user and its surroundings. CONSIGN seeks to alleviate pressure put on workers and the industry through an alternative delivery workflow.

Explanation

The primary benefit of the CONSIGN system is to reduce the amount of time and effort required by the user to deliver a package to a receiver. The user of this vehicle will be less fatigued, and has less needlessly decisive choices to make thanks to the assistance of the integrated technology and features built into this specially configured van archetype. For the user to benefit, by research and analysis, there are key points that must be met through the features. This section will address each point in the design brief with the features associated.

Efficiency

- The electric motor allows for a large improvement in efficiency through elimination of idling when routing. Virtually unlimited torque allows the engine to carry large payloads without special engine improvements.
- The parcel locker system allows the company to deliver packages en masse and organized much faster than the manual methods employed by company workers currently. It becomes an automated system than doesn't require a user to do any lifting on the job, instead being handled by conveyors and lifting arms.
- People can retrieve their parcel at their own pace rather than missing a drop-off. A timeframe will be sent to their phone through their delivery company.
- The loading arm feature will speed up stops of heavy loads considerably. In the case of industrial part drop-offs, it will no longer be necessary for a forklift to offload cargo such as pallets or specialized cargo boxes for the CONSIGN size.
- There is still traditional shelving for standard deliveries for people who cannot access a Locker or for high value items. A mix of package drop-off styles will improve the efficiency of the delivery system.
- Canopy system allows the user to exit and enter the vehicle swiftly. A one touch system with hydraulics make it effortless to open and close for users of all shapes and sizes.

Security

- The vehicle will have a LIDAR system that doubles as a security system to watch the vehicle when people get too close to the compartments of the vehicle. This will alert other people in the area through emergency lighting, sound, and a notification to the driver.

- Parcel lockers, similarly, will have tampering preventions to keep people from stealing parcels. They are deployed in public areas to deter tampering. Designated spots for the lockers can grab the ground to prevent pushing or stealing of entire units.
- These premeasures are preferable to leaving package on a doorstep where it is vulnerable and unguarded.
- When delivering at night, the area around the vehicle will be lit with LED lights on the underside of the overhanging roof to deter unruly threats.

Awareness

- The standing seat option allows for the user to stand above most cars height and provides a greater line of sight.
- Being centered in the vehicle gives better mirror coverage and visual balance for reversing. It's a feature used in farming tractors.
- A great array of 360 lighting improves sight of all objects and to warn people of operations taking place. The lights will appear blue when parked on standby, for example.
- Front entry makes it easier to look at your surroundings when entering and exiting the vehicle.

Technology Integration

- Heads up display makes the user more engaged with their route without sacrificing safety.
- Easy work-phone docking on the right-hand side makes entering and exiting simpler.
- LIDAR technology is the premier method being developed for autonomous driving and pre-collision awareness to avoid accidents and save problems before they even happen. It doubles as a security function, as mentioned.
- Parcel lockers are fully driven by phones which can act as keys to compartments to make the user experience seamless.

Ergonomic Adjustability

- As to be explored in section 5.2.1, the seat has a swift adjustment system to adapt to many bodies and how they wish to sit on the job, making users comfortable as intended.

Urban Blended

- CONSIGN is an urban industrial vehicle that uses a colorful splash of orange by default, but can match the branding of any company using it.
- The wings on the back are perfect for logo integration of the company, and allow quick replacements if ownership is changed.

- The large roof has the ability to advertise to people from the skyscrapers.
- The thin profile has an advantage at weaving through corridors and one-way streets.
- It has a futuristic appeal to it right now that brings excitement and new energy to a city.

Visually Understandable

- Companies already use the parcel locker technique with communal postal boxes and deployable command stations in parking lots during peak seasons so its integrated into society already.
- Standardized key padding and touchpad interface with clean UX will provide a familiar user experience similar to advanced vending machines

Cost of Ownership

- Companies will appreciate the time it saves on the road which saves operational hours and cost of maintaining. Electrical engines are more reliable than the hard fuel counterparts.
- Easily replaceable panels allow for hasty repairs when needed.
- Companies could benefit from an autonomous integration in the near future.

Modularity

- The internals of the vehicle share a lot of similarities with a van, including its ability to install different outfits for different jobs. A railed floor and walls allow for quick installation of new upfits and specialized tools that a company may require
- The vehicle can be repurposed in emergency situations as ambulances, shelter, and event offices due to its standing height in the cargo bay.
- People can adjust their chair to their liking to make it feel more personable.
- Open shelving allows users to organize loose packages as they please increasing their comfort and personalized workflow.

Interaction with Cargo

- Users have to interact less directly with the packages improving their physical condition and time used moving items manually.
- Receiver's can put more trust in the locker system and still receive packages without a local radius near their residence since cities have a high density.

Benefit Statement

CONSIGN was designed for the parcel deliverer to make their living's easier through all of these feature's listed. They will have more time to focus on the job of driving in busy traffic and having to worry less about occupying spots for a long time. They can have comfort of mind having more of their blind spots covered. They don't have to dread that flight of stairs that the receiver would be walking anyways. It gives some power to the user that current package cars don't provide because they're too focused on the packages rather than the people.

To reserve sidewalk space for the parcel lockers, this becomes a citywide initiative. It'll make a city more efficient in getting goods around and reduce the amount of delivery vehicles on the road and how long they have to be on the roads for. This eases gridlock for everyone. The silent engine will benefit anti-noise pollution. It will bring a new look to vehicles on the roads and blend in while standing out at the same time.

Receiver's will have the inconvenience of not having door-front delivery, but they gain potential price savings through a subscription program, a better security system of their goods, and they're likely going to pass the locker in the vicinity of their apartment in the urban core. It working off the idea that a lot of ride-share systems are using that people are already on their way to a destination so why not try to make it productive.

Companies will see happier employees and swifter movement of parcels. Specialized companies such as electronic distributors could use CONSGIN as a standard cargo vehicle and deliver pallets to worksites and no have to wait for a forklift to be available to drop it off. There a potential to the system that can benefit companies large and small, making consign a great investment in the long run of their company.

5.2 Design Criteria Met

As required by faculty, there are certain elements that must be met for the success of the project. These elements will be discussed in this section.

5.2.1 Ergonomics

As stated early in the problem, the solution would require 3 points of contact as requirement by course requisites. CONSIGN is a concept vehicle that has many points of contact and use. However, the primary area of address is in the driver's seat which uses an uncanny standing seat styles that is experimented in some waiting areas and is seeking development for airplane flights.

The advantages of the seat allow the user to enter and exit the vehicle with less effort for the stop and go nature of delivery jobs. It also allows the chair to rotate on the spot using a small turn style which gives the user access to the rear cargo storage without having to exit the vehicle first. These conveniences the user and prevents them from getting in harms way more often.

Images can be found with scale figures in appendix F-3 to showcase different users in the leaning position and a wheel. These dimensions were used for the finalized CAD model. While the final model doesn't have the engineering, the concept is that the seat can move down and the seat pad can raise to provide a standard seating position if the user would rather have that option. Modularity and comfort were one of the targets of the project so it became a feature of the seat. Its all adjusted by one level that brings the seat upwards and downwards, and also adjust the pedals of the vehicle and the steering wheel at the same time. Since the motor is not like standard analogue engines, this is all achievable for ease of the user.

Technical drawings in section 5.5 also show key dimensions in the seat geometry.

Additional ergonomics includes

- An adjustable heads up display to keep the user attentive and informed about their route to reduce time on the road. It can be combined with a easily reachable phone dock that is used for verifying the drop-off of packages.

- One touch canopy opening and closing with lightweight frame for emergency non-powered situations
- 5.5" ceiling in cab is near full room requires for a 95th percentile man to be standing fully upwards. The cargo cabin has additional clearance as listed in section 5.5.
- Loading arm is controlled through an app on the vehicles associated work phone. LIDAR makes detection and usage easy and hands-free of heavy lifting.
- Parcel vendor dispenses small packets at the ideal height in the middle range for 5th percentile woman and 95th percentile men to reach (illustrated in section 4.1)
- Low-to-ground body for flat city streets makes less of a step to exit the vehicle. The front has a step as well to improve ease of access.

5.2.2 Materials, Processes & Technologies

CONSIGN is a vehicle that is largely made of traditional methods of automotive manufacturing meaning that it is accessible technology and materials that are already being used on the market and have been proven useful.

- An Aluminum body saves weight and improves mileage out of the vehicle improving its environmental impact and contributes to recycling when retirement comes.
- An electric engine of compact size to fit under the hull of the vehicle. The battery would be accessible through the side running panel and replaceable as needed, as current battery technology is on lithium ion cells.
- Outer shell parts and the roof would be constructed of automotive polypropylene for aesthetics and injection molding.
- Paneling would be constructed of aluminum to protect the cargo bay.
- High quality weather resistant plastic tarp or pleated aluminum paneling would be used as the back-sliding doors.
- Interior would use injection molded polypropylene parts to cover internals.
- Cargo bay floor and lower hull is made of steel for sturdiness and resistance to bend to increase payload allowance for up to 6 parcel lockers and the automatic movement rail system.

- Solar panel would be installed on the roofs of both CONSIGN and the Parcel Lockers for auxiliary power to supplement the battery's usage for secondary electronics besides the motor.
- Parcel lockers would be made from aluminum paneling for security. Intricate framing would support the load and prevent tampering.
- LIDAR technology would be equipped to CONSIGN to increase awareness and align vehicle for parcel locker deployments.

5.2.3 Manufacturing Cost Report

CONSIGN is a generally standardized manufacturing process as far as vehicles come. It is most replicable to the Mercedes Sprinter or Nissan NV Cargo which have a comparable price of \$50,000 range at retail. This makes the actual unit approximately \$40,000 to produce. However, due to electronic engines and premium features such as engineering arms made of reinforced steel, approximately \$20,000 can be added to the manufacturing costs. Autonomous technology can add additional costs of \$30,000. A fully kitted unit with parcel lockers could cost upwards of \$100,000.

Companies such as Tesla are greatly trying to reduce the cost of electrical engines and access to technology. As a product designed for the future, it may be more economically feasible in the next 5 years. Since the product is meant to generate revenue through deliveries, its use of high-quality materials and functions increase productivity and results in a larger budget/revenue. To increase direct profits to the company, it is proposed that the parcel locker system be used with a subscription system to their delivery service.

Autonomous driving, while in its infancy, will become more commonplace in the near future. Already, CONSIGN would not require a driver which potentially saves employee costs. They could also use the rotational seat to set up an administrative station capable of doing paperwork while the vehicle is on the road. A concierge, of sorts.

5.3 Final CAD Renderings

Photorealistic Renderings done in Keyshot 7.







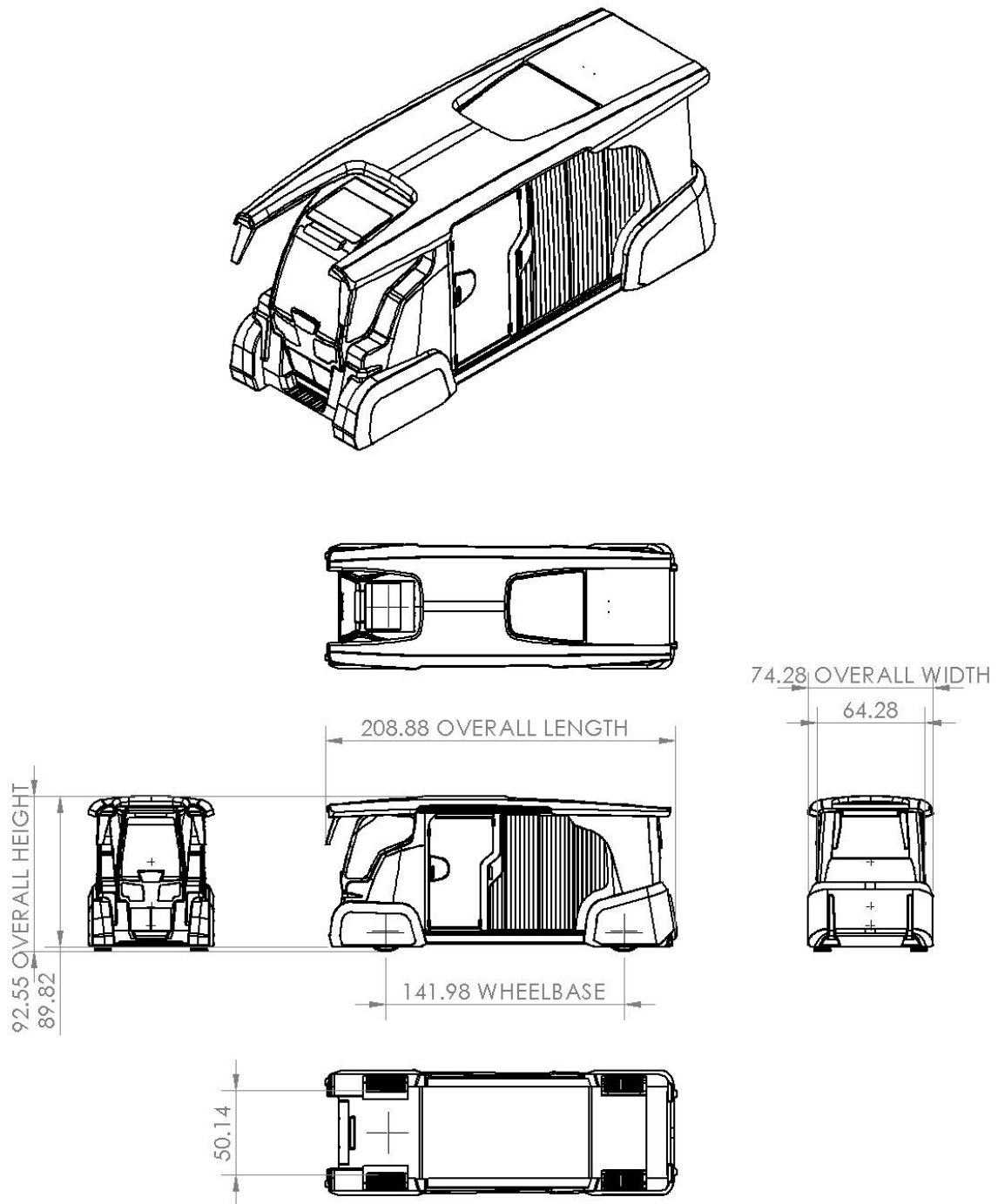
5.4 Hard Model Photographs





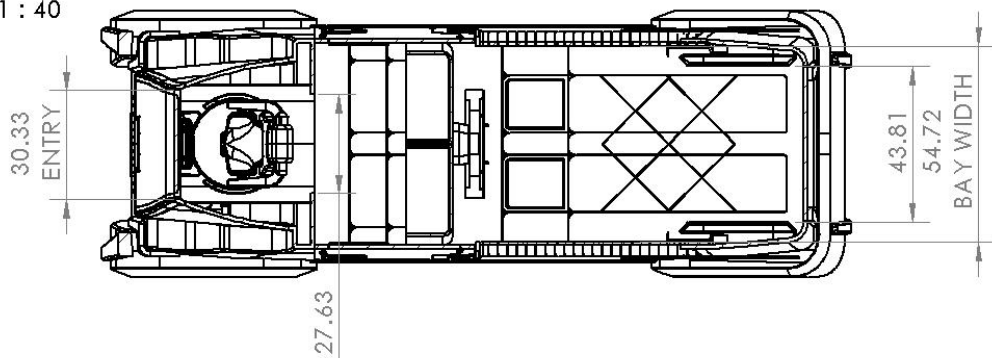
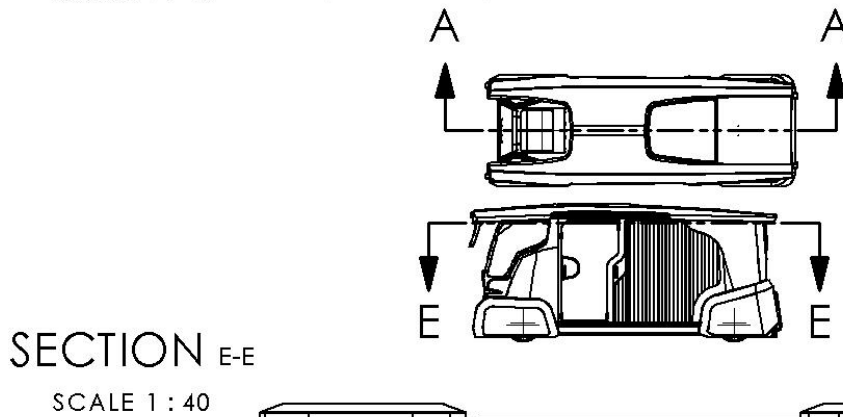
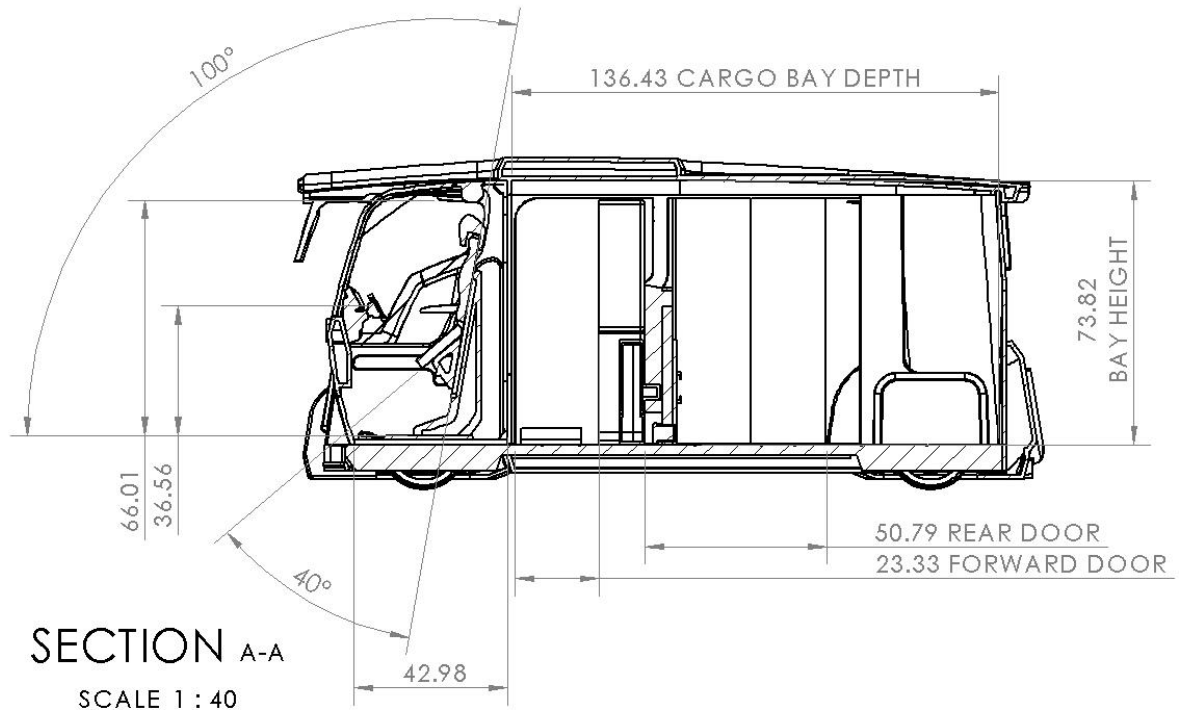


5.5 Technical Drawings



CONSIGN - EVAN DEMCZUK - APRIL 10 2020 1:75th SCALE

MESUREMENTS IN INCHES



5.6 Sustainability

This Metropolitan Parcel-Vending System Transport was made with consideration for adapting the parcel-locker system to urban environments to make better use of fuel and time. The use of lightweight materials such as carbon fiber infused plastics, highly resistant fabric covers and recyclable steel. A thinner silhouette and maximization of internal space makes loads more space efficient. Cargo boxes allow for delivery step skipping to save resources. Single seater vehicle utilizes less materials for the cabin. Electrical propulsion systems and adaptability to improving hydrogen cell technology allow the vehicle to be retrofitted. Upfitting and modularity friendly components allow for multiple uses and longer lasting operation. Optional solar roofing increases vehicle range while powering internal AI systems that accommodate a user's tasks in exception to being a tool that is just used.

Electric engines have many sustainability benefits depending on its originating fuel source for the electricity. It is generally considered the way for humanity to advance our sustainability efforts. The engine can turn off when stopped and prevent idling. The silent engine reduces environmental noise which plagues urban areas and makes it a more neighborhood friendly tool of the industry.

Time-saving from proposed methods of operation can allow the vehicle to save as much as 50% of time in running costs allowing it to accomplish more with less fuel and stress on the user which therefore improves the economies potential.

CHAPTER 6 - CONCLUSION

The urban landscape is a fascinating place of residence, commerce, and work. One of the largest underlying industries that run a city is its ability to move goods from one to another. It's become such an overpressure industry that pushes their workers to get goods moving as fast and efficiently as possible. In the core of a city there's a lot of risk the user has to take in their daily routine, including illegal parking, dense traffic navigation, compact spacing, and needing an overwhelming sense of awareness to function. This physically and mentally stresses the user.

CONSIGN looked into the lives of these users and the environments they're in, the industry as it is, and the function that they require, and adapts to them all through a full-body, research driven design process. Key needs found developed a design brief that requires a product that can be efficient, secure, awareness improving, technologically integrated, ergonomically adjustable, urban stylized, visually understandable, low cost of ownership, modular to all help the interaction of the user and parcel, delivering to the receiver, who too, is a user of the product.

CONSIGN delivers on all these fronts, providing a unique system alternative to companies to deliver parcels, product, and goods through a fully inclusive system. It has the flexibility to be more, to be upfitted and modified, but is a strong canvas with improvements to the everyday van. A person can interact in multiple ways using the full range of motion. It experiments with a vertical seat for driving purposes allowing for ease of access of the vehicle. It upgrades navigation technologies and visibility, and is prepared for a future of AI alongside human work.

CONSIGN is a vehicle that would add a splash of color to the city and a new hope for delivery workers to take that edge of their deliveries.



Thank you for reading.

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APPENDICES

Appendix I (A) - Needs Report Data

Benefit #1: Ease of moving packages in last meter

Product that Affords: [Hand Truck \(dolly\)](#)

Loop Handle Steel Hand Truck with Rubber Wheels

800 lb Carrying Capacity *by ULINE*

Price: CDN\$ 141

Product Description

- 10" Solid Rubber Wheels
- 51" Height
- 44 lbs weight
- Loop handle
- 14x8 Beveled nose plate
- Control tall loads with one hand
- Third handle perpendicular to face
- Replacement wheels available

Specifications

Brand Name	Uline
Colour	Red
Material Type	Steel
Model Number	H-1786

<https://www.uline.ca/Product/Detail/H-1786/Hand-Trucks/Loop-Handle-Steel-Hand-Truck-with-Rubber-Wheels>

Benefits	Features
Easy to maneuver heavy packages Ease of sliding under packages Alternative holding positions / one handed Rough terrain ready Climbing stairs easier	High capacity in weight Beveled front edge Third angled bar perpendicular Heavy duty wheels Large wheels

Statement of Need

A transportation decides for parcels which affords
 Ability to move heavy parcels with control
 Offer options for the user to be comfortable in use/task
 Secondary specific needs
 Use in rugged terrain/ ability to move around obstacles
 High durability and resistance to fail
 Ability to store in areas of need (specifically vehicular)
 Flexibility of load

Benefit #2: Accessible storage for transportation

Product that Affords: Cargo Van

Mercedes Benz Sprinter Cargo Van

<https://www.mercedes-benz-vans.ca/en/sprinter/cargo-van>

43,000\$~ Canadian

Product Description	
<ul style="list-style-type: none"> • Gasoline or Diesel engine • Active brake assist • Best in class cargo value • Upfitted friendly • All standard commuter amenities 	

Brand Name	Mercedes Benz
Colour	White or Black
Material Type	
Model Number	Various Years

Benefits	Features
Maximizes inner to outer space ratio	Compact form factor
Ability to outfit with different modules	Upfitter friendly / Vertical walls
Increased safety of driver and cargo	Active brake assist
High payload capacity in class	Up to 6,700 lbs load capacity
Standard comfort for driving	AC, Adjustable seating, Radio
Multiple side accessibility	Rear and Side access
Ability to move rear doors out of the way	Full swing doors
Option to choose fuel type for associated benefits	Gas or diesel engine

Statement of Need

- A transportation decides for parcels which affords
- Ability to move many, heavy parcels with control of a single person
- Have the power appropriate for safe control and use of a stop-go scenario
- Secondary specific needs
- Flexibility of load
- Protection of goods from threats
- Ability to communicate with other people
- Affordable for small businesses
- Ability to modify for use

Combined Statement of Need for Benefit #1 and #2

Statement of Need (Storage and Transportation)

It is required to have a transportation product that is capable of assisting a delivery industry worker in having control over lots of packages in an organized, modifiable storage space

Specific needs include

Affordability

Safety of the person, the goods, and those around them, from potential harm and damage (as the property is not the worker's)

High control with multiple options to fit the worker's habits and environment

Statement of Need

The transportation of parcels is a necessary job to move goods to an individual in an efficient and comfortable manner for both the worker and the packages which should be treated with the utmost care and control (security)

The transportation also needs to be easy for the worker to manipulate the environment of the product using efficient engineering. They must feel able to act autonomously with such products and cargo.

They must have the confidence to handle loads and feel accomplished about being able to move people's belongings to those people.

Appendix ii (B) - User Profile & Demographics

Abstract

The modern-day postal worker is a job that is done for many people, but the worker himself is a person who has needs, and my thesis is looking to address their workflow. In order to do so, I'll research the demographics, behaviors, and cognitive aspects of these workers to build a persona which showcases the lifestyle that they are living, in average.

The research shows that most workers don't need to be skilled but have a good work ethics that involves skills such time management and social responsibility, that are both driven by responsibility. The workforce is largely white male, but still has a large female presence. The workers must be fit to be constantly on the move, assisted by products such as trucks and bins.

This research will reveal that the workers are often stressed with their job and pushed to the max efficiency, but may be held back by their products or lack of features, leaving a lot of physical stress on their bodies, as well as pressure on their minds to keep the job for stabilities sake.

Image Search



Figure 2 Runzel, T. (2018, June 29). What Is Required to Be a Postal Worker? Retrieved from <https://work.chron.com/required-postal-worker-13092.html>



Figure 3 postal-worker. (2019, April 6). Retrieved from <https://cd2action.com/h-res-23-u-s-postal-service-should-continue-door-delivery-for-business-residential-customers/postal-worker/>



Figure 4 Martin, T. W., Morris, B., & Thurm, S. (2013, August 21). UPS to End Health Benefits for Some Working Spouses of Employees. Retrieved from <https://www.wsj.com/articles/ups-to-end-health-benefits-for-some-working-spouses-of-employees-1377116651>

Conclusions

The image search outcome large presented males in stock photos... or intentional smiles/looking at the camera. Largely White male, in graphics too. Some Black, and no Asian ethnicity images compared to the statistics. Images mostly show van use, and walking. Few motorcycle/bicycles. Generally tall and relatively fit. Dressed in uniform, often with a hat, likely due to elements being common problems. Often have large courier bags. Some image show hand truck use. Often depicted spending time organizing parcels. Literature search was mainly driven by DataUSA and a couple other sources. Some interesting facts include a decline of workers due to automation, and current carriers will have larger routes. And rather than average, there is a low bar for entry into the industry, and can be straight out of high school. Meyers says that it's an ageing workforce, with few young workers. It's often a second career in that case, most people study business, or other, first and then end up in postal (which doesn't require). DataUSA also suggests that you need strong social skills and organizing for the job, among other skills, including vehicle operation, listening, critical thinking, reading and writing, and exception time management.

Evidence

"On average I would deliver 170 parcels a day, and on my busiest I delivered 254." (Anonymous, 2019)

"Working as a self-employed courier in the run-up to Christmas meant 16 hour days with no breaks. It meant arriving at the depot at 4.30am to sort parcels and on some days not finishing the shift until about 11.45pm." (Anonymous 2019)

"But there were days when come 10pm, even though there were still parcels in the van, I would think I cannot do any more of this." (Anonymous 2019)

"And while a lot of the customers that I knew were brilliant, I would face aggressiveness and abuse from those who expected their parcel yesterday and would see it as my fault." (Anonymous 2019)

"When I first started in June 2016, it was at a time when my main role was to care for my dad. Back then if a round came up, dad would come with me and it worked well for both of us - it was good for him to be out the house and it suited my lifestyle." (Anonymous 2019)

"Almost half of the injuries in 2017 were from slips, trips and falls, and more than a third involved manual material handling. For the year, total injury frequency (all injuries that require professional medical treatment) improved by 2 per cent over 2016." (Canada Post, 2017)

INTERPERSONAL SKILLS: To interact with the public in a friendly, professional manner

Organization AND EFFICIENCY: To ensure that the proper mail is collected and delivered on time to the public

HONESTY AND RELIABILITY: To ensure that mail containing personal information or money is delivered unopened and undamaged to the intended parties

Physical strength AND ENDURANCE: To carry heavy mail sacks and parcels for deliveries, and drive for long stretches of time

(Roberts 2019)

"Because mail is delivered six days a week, many USPS workers work on Saturdays. Some may also work on Sundays." (Roberts 2019)

Conclusions

The most predominant behavior is largely driven by overworking. Many workers are pushed to deliver countless packages and stay organized and motivated with virtually no help. Motivation is often

driven by profit, sometimes being paid by the parcel. Overtime is very likely, and federal postal hours extend into weekends. They must be reliable, responsible workers that do not tamper with mail, and treat other people's property with care. Organizational skills are key, and these people must know how to process their time and equipment swiftly, despite lack of time, which may weigh on their thoughts and behaviors. People will bring external help if needed, but unsanctioned by the delivery service, which drives a question of ethics. Overall, worker behavior can be summarized as stressed, but focused.

User Profile

Trying to find patterns in this field largely point towards users being only motivated by money; they don't like their circumstances and the pressure to do so much work in a extremely efficient industry. They understand its an important job but it often doesn't drive staying in the field. Stability and security of a job is the primary drive. If working for federal post, benefits can also drive. Unions have that element of security they need. They are only assisted by products that are very utilitarian. I assume they're honest workers that like to socialize and see people enjoy getting mail, but that ability is often pushed down by delivery times and their need to be punctual to avoid overtime.

Persona

Name: Christopher Anderson

Age: 52

Job: Federal Postal Worker, 12 years

Education: Business degree

Relationship: Married, 3 daughters

Location: Suburban New York, delivers in city

Hobby: Coffeeshop socials

Frequency: If he can find time

Works on average 10 hours shifts, currently 6 days a week because its holiday season

Profile:

Chris is a Caucasian male who went to college for a business degree but couldn't keep up with the changing atmosphere and fell into postal work to pay the bills for his family. He's making \$52,000 a year. He has to help his ailing father which puts on more financial pressure to keep his job, as well as anticipating 2 teenage girls entering university, with one already enrolled.

He enjoys social gatherings and getting to interact with people, so he thought postal work would be ideal for meeting with unique people, but found the job much more demanding than he anticipated. He spends long hours in the postal truck, and suffers from back pain from constant lifting. His family is concerned for his well being, but he knows its an honest job and it pays so he keeps at it.

He's gotten very good at his job over the years, and has a high efficiency rate, but gets frustrated when problems in the postal system get pinned on him by customers. His high organization skills and honest respectful personality aren't appreciated enough. He finds that having his father ride along with his deliveries to help both improves his mental health and gets his father out of the house.



Figure 5 Postal worker retires with four decades of experience. (2019, May 18). Retrieved from <https://www.smdp.com/postal-worker-retires-with-four-decades-of-experience/175621>

His truck is showing its years of use and has seen lots of maintenance. He's done his best to understand the vehicle and all its limitations, including storage space. He's had to replace the wheels on the hand truck many times, and could never find a way to hold it comfortably, and it's becoming harder to move as he ages. While he's always exhausted seeing his truck, it's his workhorse and he wants it to be reliable.

Conclusions

The relationship between the postal worker and his tools is very utilitarian. He thinks of it as a tool, and requires it to be reliable, but wishes it was more fitted for his actions and his age. Its lack of organization methods means it's more on the worker to fit everything in order of his deliveries, which can be very time consuming. Other tools such as hand trucks are basic and don't cater to anyone in specific. Much physical effort is required, and that ability is changing a lot in the age range. Overall, the postal worker has a utilitarian use for his equipment, but doesn't feel anything special for it. He doesn't have the motivation that allows him to enjoy the job, which makes it hard to enjoy a utilitarian product.

Resources / References List

Appendix iii (C) - Interview Transcripts & Survey Metadata

Foreword

This assignment did not go as planned, and I've learned that it's very difficult to get in contact with people working as parcel deliverers. I went to distribution facilities and there's many layers of security that prevent me from getting interviews in a timely fashion. I'm not going to catch people finishing their workday in the parking lot nor during their working hours. Employee lots have relatively high security and are considered trespassing too. FedEx's distribution center was very unintuitive and when I found the security office and explained my position as a student and they were just confused, told me it was "unappreciated" and gave me the cold shoulder. Taking a morale hit, I went to UPS and found the employee office and got the name and email of the head of building to contact with... in a weeks' time. There are layers of security that won't allow me to interview without clearance. Finally, I went to a local courier which was not available, though hopefully in the future I can get an interview. The groundwork set will hopefully be beneficial to my thesis in the near future, but I could not produce results for this assignment. In the end, I interviewed my father who has worked in the delivery field, and gained some insight there despite being arm's length. Additionally, I found a fellow chatroom user online who works in the USPS, and was able to answer a good lot of questions for me providing good insight into rural postal workflows.

Interview 1

This interview was done with my father, Dan Demczuk, who has worked in the delivery business as both a furniture delivery employee and an electronic supply business employee. We decided to talk about electronic supplies in particular because of its relation to parcel delivery.

Method

1. how much do you enjoy your career as a parcel delivery employee
2. Describe to me your average workday, and please expand on your preparation
3. What kind of vehicle do you drive
4. How does that vehicle handle, do you wish anything was improved in your driving experience
5. How comfortable are you while driving?
6. When you stop to make a drop-off, describe what you do (open door, open hatch)
- 6.5 is parking an issue
7. Have you ever felt unsafe while out on the job
8. Have you delivered at night and is there any issues or benefits to that?
9. What other tools than a vehicle do you use
10. Do you ever feel uneasy handling parcels
11. Have you had issues walking from the vehicle to the drop off point
12. What happens when you deliver to apartment buildings / office complexes
13. Have you ever suffered pain or injury related to working in this field
14. Do you think a drone can replace the work you do? Are there tasks a drone could not handle?
15. Are there any other stories/experiences you would like to share about delivery (that pertain to your efficiency)

Findings / Evidence

Name: Dan Demczuk

Contact Information: ddemczuk@sympatico.ca / 905-960-2870

Date & Place: October 9th, Home

Duration: Planned 15, went 30 minutes. Signed consent form.

Transcript:

E: So, how would you say you enjoy your career as a parcel deliverer.

D: Well, traffic is always a challenge. And trying to make an efficient route is probably the hardest part of the day. To get everything delivered on time.

E: Describe to me your average workday, and expand on preparation, like when you're loading the vehicle, what kind of processes do you go through.

D: There's always a last minute, in our case, a last minute add-on, like, the day before there's a list of things that have come in and been processed, and that we know that they're ready to be delivered. So somebody else will call, and make sure that there's something coming that day, but they won't know what time. It all depends on the route goes, so once we have all the deliveries and pickups for the day, I will plan that route accordingly.

E: and how would you plan that route?

D: Well, the first thing I do is subdivide it into basic areas, like York region, Durham, etc.

E: and that's all done manually?

D: Yes. Cause, right now we don't have any software that will do it automatically, and there's small companies here and there so you sometimes have to go into google maps to fit it, slot it where it goes in the day. Once you have those big groups, you further refine the list, group, and I've been using an excel spreadsheet to automatically sort the locations. I have a database of 200 (common) locations. I order these and then sort to those to get my list, then delete the rest. And then I will take those 20 or so and that's my route. Does that make sense?

E: Yeah, that makes sense. And when you're actually loading the truck, what so of physical labor do you do.

D: Unfortunately, we don't actually have a proper loading dock. The truck that we use, a Mercedes Sprinter, even though it is a bigger van it is still low to the ground, which is great out on the road, our dock is like 4 feet off the ground so we literally have to bring an aluminum ramp to load heavier merchandise.

E: and you do that with a hand truck?

D: We have a pump truck for skids, which obviously, weighs like 700 pounds (the payload), and then there's reels of cable that are 48 inches, and weight 100,000 pounds (laugh). But, most of the stuff is small boxes, yknow, they're individual, because we're an electronics supplier. A lot of it is just one or two boxes. On the other hand, because we are an electrical supplier, we have 10-foot lengths of conduit and um, pipes, and that kind of thing, so, we have a big mix of product that isn't uniform, unfortunately.

E: And are all those parcels marked in some way? Like, how do you pull them out when you get to the stop?

D: Yes, they are marked. Whoever does the, in the warehouse, the picking, off the shelves, will then package those items into one or two boxes, and they will write on the package who it is going to. I have suggested that we also add the PO number, but they haven't done that yet. So, it gets a little confusing when like there a company with more than one location and you don't know where its goes, because its just a box, with a company name.

E: The sprinter, how does it handle, would you say. Like, on the road.

D: It's a breeze to drive, the visibility is great, I love the fact that you can, um, it has a 9 foot clearance in the back, so you can stand up, and you don't have to slouch over and hurt their backs when your offloading. So, there's a lot of space in the back for loading, but because of that height, if there's high winds, or a crosswind, It could tip over. Especially on highway on/off ramps.

E: How comfortable are you when driving, what sort of amenities does the vehicle have.

D: Air conditioning. Its key. Yeah, air conditioning. But also, in the winter, it also has a fast defrost, so you're not waiting long for the vehicle to warm up.

E: and the seat?

D: very comfortable.

E: Is there a step up from getting in/out of the van?

D: That is a hard thing for a driver with weak knees or a bad back, You literally have to slide down or jump down, and when you're doing 20 deliveries/pickups, that's 40 times you're getting in a out of the vehicle, know, 40-50 times a day, it becomes an issue, A built in step would be nice...

E: There's no step? (laughs)

D: (Laughs) no, there's not. You have to open the door and climb up. Some trucks have a bolt on, add on step. I think at one point I did talk to the owner and general manager about getting something like that.

E: When you make a drop-off, like, from, when you're sitting to when you're sitting again? What do you do? Like do you get down, go around, and open the doors at the back...? Like, what's that exact process, you just can't spin around in your chair or...?

D: No. You can't. the cabin is isolated from the back, you're not wasting fuel, heating the back, you're just heating the crew cab. The second, pro... for that kind of setup is that when you have something very large in the back that could potentially hurt the driver, when they might be forced to hit the brakes, whatever comes flying forward, a skid of... lead or whatever, won't come crashing through into the seat and dash and

the windshield. The barrier will stop it. It will impact the barrier. So yes, you have to get out of the vehicle and go to the side sliding door, or rear doors. Typically, what I do is loading the deliveries at the very back and anything iw as picking up I'd start at the front.

E: So, you also pickup product/packages as well?

D: exactly.

E: Do you use any other tools when dropping off or picking up packages?

D: It would be ideal to carry a pump truck, but it's not feasible, because of how heavy it is and there's no practical way of stowing it. It will roll, unless you secure it somehow which adds time. So, what I ended up using is a um, tow rope. If there was a skid that had to come off, your forks can only go as far before you hit the bumper, so you can only reach so far, and if the skid is deep, you can't get it off. So, what I would do is use the tow rope and pull it, or attach it to the forklift, and pull it far enough back to remove.

E: Unfortunately, my project isn't going to be focused on pallets, but It may definitely be something to consider. So, all small packages you just...?

D: Hand bomb.

E: Hand bomb.

(both laugh)

E: So if you have a lot, you just shuttle it back and forth, you can't just carry it all at once?

D: We have a contract with the university of Toronto, and they order a lot. So typically, we go to UFT once a week, and typically have 40-60 packages. When I get down to UFT, I go to this cage area where they stow stock, and you're not allowed it, security and such, but they have big dollies with the flatbeds and four wheels and a (gestures) U shape handle. And I bring that out and load all of my packages on that and wheel it back to the cage.

E: Is there any issues with parking? Of course, there is... (both laugh)

D: UFT is the worst

E: Can you describe the environment you have to park in?

D: We deliver to so many places, there dozens of scenarios.

E: What are your main obstacles then?

D: you pull up to a loading dock, and then, have to go inside and stipulate who you are and what you're doing, dropping off or picking up, and then go back out and do that. But, um, some places are really tight. They're... insane. (both laugh) First of all, its an indoor covered parking spot, but to get to it, but its right beside their landscaping trucks. All their vehicles, and the same place garbage and recycling is picked up, and other companies delivering their things. Its always a zoo. And there's only one way in going down, and in, the whole area could be full. So you have to wait your turn. And you have to wait for people to clear/leave, and I've had to wait half an hour sometimes. And sometimes ruins the rest of the delivery day,, when you promise somebody something and due to the circumstances you cant get things delivered and you have to cut. Most of the time we would forego pickup and do it first thing the next day, but we always try to get all deliveries done so they're not left without their product.

E: Alright. We're over 15 minutes, and are you good to keep talking?

D: Yup.

E: Um, with that whole process, what is the environment like itself? Like is there any bumps you have to go over, you have to traverse.

D: The biggest factor is weather, especially snow days. Because no matter what you have to go out and snow will definitely hamper the amount of stops you can make. The amount of times I went out (in snow) it would take me 3 hours to get down to the city (from Newmarket). Its just, traffic everywhere, people in the ditches. Snow, is the worst. Rain not so much. Even though the sprinter is a big van, its easy to drive. So, it handles like an SUV kind of. It is long, so if you stop at fast food, (pause)

E: its going to take up room in the parking lot...(both laugh) Yeah, so is there any sort of amenities on the vehicle for that? Like...

D: Yeah, there's a fold down tray. It can fit like a laptop. There's a wider one that folds down (for eating)

E: oh. That wasn't what I meant to ask, but its useful. Is there any sort of sensors that the vehicle has?

D: It has a backup camera and there's a warning beep. So a fair amount of safety features. Speaking of safety features...

E: This is where I wanted to go... Have you ever felt you were in a position where you were unsafe on the job?

D: Getting back to the wind, there's actually a sensor, something like. cross...wind...alert? And it basically takes power from one side of the wheel, so it brings the truck down, and tells you.

E: have you ever delivered at night, and is there any pros and cons to that?

D: well its always more difficult to see in the dark... just like snow, it's a hazard. Vs the day.

We don't typically work at night but during daylight savings the early mornings can be dark, while your loading and the first couple stops.

E: And is there like, any illumination?

D: the back of the sprinter is fully lit. It has great lights, interior cab lights and cargo bay as well. There's led strips that run abut a third of the entire vehicle.

E: and on the outside?

D: yeah.

E: and have you ever felt threatened by traffic and things around you or are you parked in a safe area most of the time?

D: Is this when im travelling or stopped?

E: when you're stopped.

D: Ummm, no, I usually leave it unlocked and running, but if I'm there for awhile ill turn the engine off. And if I go away, such as a lunch stop, I will lock the vehicle, because public spaces will a lot of product, expensive product.

E: Have you ever had any, suffering or pain related to the work?

D: No.

E: Nothing come up, no twisted ankles?

D: No, but over at McDonalds (furniture delivery job before this one) I got a pinched nerve.

E: and that's furniture delivery so that's heavy duty.

D: Yeah. But no, not at this job.

E: Um, here's abit of a bold question, do you think a drone could replace the work you do?.

D: No.... no.

E: And why do you think that?

D: Because, our, there is no drone now, or in the foreseeable future that can lift the amount of our products. When we're talking 1000 pounds.... Yeah.

E: And how about small packages?

D: The smaller packages... yes. Like what amazon is trying to do. But...

E: So you think that could navigate the complexes you deliver to? The buildings and terrain?

D: well the problem is, we deliver to the majority of the GTA. Like my typical day run can be from 300 to 350 KM in one day, which is a lot of driving. I could start here in Newmarket, go to Keswick, then Pickering, etc. So no, I don't think drones are capable of doing what this company is doing. I think drones would have to be local, in a 10-20 km radius rather than longer.

E: is there any fuel issues with the vehicle?

D: Runs on diesel. Big tank. I stop every third day, other day?

E: and just to finish up? Is there any other stories or experiences that you think that could pertain to the products that you use that could be beneficial to this study?

D: Some kind of shelving system or rail system in the back for skids, without a machine. Maybe some sort of shelf unit so they're stowed up and away and not buried. I've used dividers before to stop things from coming, rolling, forward, and crushing delicate or fragile boxes. Some sort of dividing systems... (Pause).

E: is there any sort of stories or problems? Rather than solutions?

D: Well one case where I did some damage but the owner as a little upset but understood, knowing it was a work vehicle. What happened was a roll of cable was loaded on to the truck, and there was another roll that was placed on top. Unfortunately, we have now implemented that two people must sign off on the delivery. We have two people check the delivery and the packages. Because.... the one thing you don't want to do is leave and realize you left something back at the warehouse. And then you have to turn back, and just lost an hour. So, we want to make sure everything was on the truck and loaded safely... so what had happened was a... I got sidetracked, the truck was started, and somebody started it for me, doing something somewhere else, and two guys loaded the truck for me, and I jumped in and took off. The problem is they stacked two reels of cable on top of each other, and when I went around a corner, the top reel slid off and rolled, and because of that divider mentioned earlier, it hit the divider and didn't come through the chair or windshield, it dented the pretention divider. So that... did its job. Unfortunately, it got dented but... that's what it was meant to do.

E: That sounds reasonable. So I think that sounds good enough for my study, is there any last comments or can we finish this up?

D: nope, I'm good.

E: well thank you for your time!

(End)

Discussion / Conclusions

Though it was with my father, I kept the interview as professional as I could. My main concern was the amount of time we spent on a question, sometimes getting irreverent information. I like to leave the questions open ended for a wider range of answers, but I may have ended up having them take up too much time. Point is, I could be more concise. Maybe ask to keep answers relatively short. That was I can still ask to expand if I feel it relevant to my topic.

A second point to improve on would be to prepare those questions better, and fewer, because a good amount of side questions came up, or were answered in another question. Main questions don't have to be plentiful, especially if they spawn smaller questions.

Key Points

- While the project is focused on small package delivery, large packages are not uncommon on to the tools and should be accounted for. An ability to carry pallets might be something to consider.
- The Sprinter Van is more accommodating than it seems. Despite the large size, its easy to handle. Its storage area is spacious but lacks proper organizing and securing. A large concern in the drop from the seat to the ground, and need to travel around the sides. Two door entry allows for things like pickup/drop-off to be organized better.
- Drop off zones can be chaotic and waste a lot of time. He had to use external tools to help offload larger orders. Loading and unloading have many things to consider. Concerned for loading docks and other types of platforms.

- Route and package organization is pretty labor intensive. Usually in a warehouse you will have the assistance of multiple people, and that may not include the driver. This break in communication and intuitiveness had led to an incident in this case.
- Weather is a major factor for Canadian delivery. Snow is the biggest hazard both in the car and on foot. Amenities such as air conditioning and quick defrosting abilities will help greatly, but sounds like they could always be expanded on. Crosswind is a major concern as well with tall vehicles.

Interview 2

The second interview was with a Discord user named BraveSaintCipher/ BSC#6106 who also goes by the name Ross. He's a family man that I learned was working for the USPS. As a friend, I asked him to help me with this report. We talked about the workings of his relatively long career in the rural postal system in Kansas.

In the near future I hope to interview him again about security in the parcel system, because he has recently graduated a course to become a Mail Detective, showing his ample experience in the industry and special knowledge in problems in the system.

Method

This interview was rather impromptu, but I had a general knowledge of the field and wanted to ask things as they came up. I started with a focus on demographics, as in how he ended up in the career, then into the vehicle that he uses. From there I asked questions about the functions and ergonomics of the vehicle, and then segwayed into storage methods and organization of the postal office and how its system worked. I end with some questions about well-being in the profession.

Findings / Evidence

Name: Ross

Contact Information: [BSC#6106](#) on Discord

Date & Place: December 11th, Online Direct Messaging

Duration: Planned 30, went 60 minutes. Typed consent.

Transcript:

Screenshots taken directly from Discord client. Read left column then right column.

Logs 1

Reikenan Last Friday at 7:04 PM
cool!
Just a headsup i might use this chatlog in my documents for my thesis and possibly reference you. That's fine?

BSC Last Friday at 8:00 PM
Of course. I'll be professional 😊

Reikenan Last Friday at 9:06 AM
other than that I'll keep this pretty casual lol
So my project is on parcel transportation; specifically systems like that of amazon and ups, etc
Though you're affiliated with the US Postal service right

BSC Last Friday at 9:17 PM
Correct. Rural Carrier with USPS

Reikenan Last Friday at 9:27 PM
Do you just deliver letters or do you handle small packets/parcels?

BSC Last Friday at 9:28 PM
Mail, and packages of all sizes.
very small, to quite large

Reikenan Last Friday at 9:38 PM
that'll be helpful
hmmm for demographics, how did you end up in the career?
Oh i suppose i should mention if theres any questions you dont wanna answer that's fine

BSC Last Friday at 9:50 PM
My dad has been a city carrier for almost 40 years, and I had recently left my management job for a break, and was in-between careers. I wanted something that allowed me to work by myself, while still making similar income. Being a carrier in rural Kansas was the most peaceful thing I could think of.

Reikenan Last Friday at 9:59 PM
I'd imagine you work with a postal office rather than a sorting facility to pickup mail

BSC Last Friday at 10:02 PM
Correct. The plant is located farther north in Kansas City MO. Those workers do very different jobs from traditional post office work.
their job entails getting all mail and packages to us,
we organize it all and deliver it
Essentially, the plant gives us a puzzle, and we assemble it and make sense of it

Reikenan Last Friday at 9:14 PM
Ok so you get a delivery of parcels for the locale but then you have to do all the organizing manually
right right

BSC Last Friday at 9:10 PM
Correct

Reikenan Last Friday at 9:13 PM
Before i ask how you go about sorting, can i ask what vehicle you use to transport?

BSC Last Friday at 9:13 PM
No problem.
The main vehicle the PO uses, and has been in use for the past...30 years almost i believe is the LLV (Long Life Vehicle).
Other 2 vehicles are the FFV (Flex Fuel Vehicle)
which can run organically
and the Promaster (which is similar to a standard Amazon delivery van, like a Ford Transit)

Reikenan Last Friday at 9:15 PM
Oh yeah my project with ABC group we made a storage system for a promaster
cool little transport

BSC Last Friday at 9:16 PM
indeed, great for parcels
terrible for mail delivery

Reikenan Last Friday at 9:16 PM
what makes you say that?

BSC Last Friday at 9:17 PM
because it's left hand drive, our routes are constructed for right hand turns, the vehicle is higher than the LLV, and the windows don't roll down all the way lol
but it has AC and heat
so win some lose some

Reikenan Last Friday at 9:19 PM
What does left hand drive mean? I realize that routes are right hand based but i dont understand how that would hinder it?

BSC Last Friday at 9:22 PM
my bad
so
LLV trucks have the driver on the right side of the truck
promaster's left
like a normal car
Our routes are designed to make us usually turn right, so that curb side mail boxes are easily accessed on the right side of the LLV

Reikenan Last Friday at 9:19 PM
Oh so the LLV is like european vehicles

BSC Last Friday at 9:19 PM
where the driver sits
correct
A left side drive vehicle makes it so the carrier has to drive their route in reverse, and into oncoming traffic to hit those same mail boxes
if that makes sense

Reikenan Last Friday at 9:24 PM
yeah plenty of
are there any other standout features of the LLV compared to normal vehicles?
they look very compact

BSC Last Friday at 9:25 PM
It's standout feature is that it has a great turn radius. The front is noticeably narrower than the front, and gives it very acute turn angles
perfect for navigating cul-de-sacs, and narrow driveways
They are called long life vehicles as well because their design is very simple, and almost to a most basic level of design.
no radio, no automatic mirrors
just lights, and heater that the PO claims to work, but is more like an asthmatic sitting in your dashboard and blowing at you with a straw.

Reikenan Last Friday at 9:23 PM
pretty much they're built to get the job done but not necessarily built for the driver

BSC Last Friday at 9:24 PM
Yeah, they're very much meant to be easily fixable, and durable

Reikenan Last Friday at 9:24 PM
One of my jobs as a designer is to build for the user, so i'd like to ask what wants would you want in a delivery vehicle?

BSC Last Friday at 9:24 PM
because they're aluminum, accidents are always risky
they fold like wet paper

Reikenan Last Friday at 9:23 PM
Ah aluminum for fuel efficiency i imagine

BSC Last Friday at 9:24 PM
Indeed
If i had to have my preferences
The most important things would be working temperature control, namely for the summer where we can't strip down enough to fight the heat
esp in places like KS where you sit in an easy bake oven for 60-100 miles delivering mail and it's 105F outside
and 125F in the truck

Reikenan Last Friday at 9:28 PM
yikes
I've heard the stories of them being overs

BSC Last Friday at 9:28 PM
It's bad

Reikenan Last Friday at 9:28 PM
many UPS drivers up here drive with the package car's door open
which im sure is a safety concern

Logs 2

BSC Last Friday at 9:26 PM
 For sure, and is grounds for termination at the PO of caught doing that
 We had a carrier last year in California who had a heart attack in her truck from the heat and sat there for hours until late at night her manager finally came to check on her. she was dead by that time

Reikenan Last Friday at 9:28 PM
 and that was because of the heat?

BSC Last Friday at 9:28 PM
 yes
 young woman
 heat stroke
 rather

Reikenan Last Friday at 9:28 PM
 unfortunate.

BSC Last Friday at 9:28 PM
 indeed
 Another thing that is necessary is the mirrors that are on the sides we have a large flat mirror for far sight behind us and a round mirror for near sight
 Here's the rub: they're so big, that they create significant blind spots at intersections and are a cause for many accidents
 We almost have to bend over completely to see around them and check before entering any intersection

Reikenan Last Friday at 9:30 PM

 you talking about this thing?
 or the

BSC Last Friday at 9:31 PM
 no those are the air vents in the back

Reikenan Last Friday at 9:31 PM
 thing on the

BSC Last Friday at 9:31 PM
 front side

Reikenan Last Friday at 9:31 PM
 how tall does this vehicle stand?
 what are the ergonomics like

BSC Last Friday at 9:32 PM

Grumman Long Life Vehicle	
Wheelbase	100.5 in (2,550 mm)
Length	175.5 in (4,460 mm)
Width	75 in (1,900 mm)
Height	85 in (2,200 mm)

 What do you mean by ergonomics?

Reikenan Last Friday at 9:33 PM
 how comfortable are the sizes of things when you're seated, exiting/entering the vehicle, reaching, or accessing the back

BSC Last Friday at 9:33 PM
 I wouldn't be a good judge of that. I'm pretty tall.

Reikenan Last Friday at 9:33 PM
 I took note of the comment on having to really stretch to see beyond the blind spots
 Well that's the thing, negatives and positives are all good notes

BSC Last Friday at 9:34 PM
 Hmm
 I think for me everything is a good fit
 Being tall is helpful as you can reach outside without being too close to mailboxes or people
 for shorter people, their needs to be more adjustable options
 seat height, and position

Reikenan Last Friday at 9:36 PM
 I noticed our mailman sometimes uses a long pole with a V for mail to reach across the passenger seat
 does anyone ever use tools like that?

BSC Last Friday at 9:36 PM
 I don't believe so, no

Reikenan Last Friday at 9:36 PM
 the LLV is built to be on the left so probably not that tool

BSC Last Friday at 9:36 PM
 I've never seen that personally
 right

Reikenan Last Friday at 9:37 PM
 Do you use trolleys/ hand trucks at all?

BSC Last Friday at 9:37 PM
 We do on the routes that deliver to apartments

Reikenan Last Friday at 9:37 PM
 any difficulties with lifting/getting packages to the door
 Ah apartments must be quite the timesink
 do you deliver to the door or to the lobby?

BSC Last Friday at 9:37 PM
 no the tailgate is a good height
 we deliver apartments to the offices generally

Reikenan Last Friday at 9:38 PM
 sorry getting carried away with the question

BSC Last Friday at 9:38 PM
 the leasing office
 haha
 no worries

Reikenan Last Friday at 9:38 PM
 so you've been able to handle large packages with just your two hands

BSC Last Friday at 9:38 PM
 yeah
 but someone smaller than me could def use a dolly or hand truck
 i mean we ship some heavy stuff and in an area of affluence like we deliver in some of these stairways and driveways are insanely large

Reikenan Last Friday at 9:40 PM
 that's an advantage of rural
 My project is focusing on urban but there's definitely things to be learned from both

Log 3

BSC Last Friday at 9:00 PM
ah
my urban exp is def limited
1 second
brb

Reikenan Last Friday at 9:01 PM
k

BSC Last Friday at 9:05 PM
automatic windows so we can roll up/down windows while driving and sorting mail would be excellent
like
the windows that go all the way up or down by a button press
We have manual hand crank windows
and they are so difficult to use

Reikenan Last Friday at 9:04 PM
that sounds like a monumental pain especially in cold weather

BSC Last Friday at 9:04 PM
yes

Reikenan Last Friday at 9:05 PM
honestly dont know how a design for this use got passed with that well alot of those LLV live up to their name i imagine and were built a long time ago

BSC Last Friday at 9:05 PM
they surely do
they are long lasting
some having 300K-400K miles on them

Reikenan Last Friday at 9:06 PM
Thats a huge plus for management in terms of cost of owning

BSC Last Friday at 9:06 PM
yeah the post office, while maybe cutting some corners in driver care (debatable), the vehicles did save money in the long run.
They were a tough, fiscally responsible, necessary evil

Reikenan Last Friday at 9:07 PM
you mentioned they dent easily... what kind of repercussions are there for vehicle damage?

BSC Last Friday at 9:07 PM
for non-traffic related incidents, no repercussions really.
they're just flesh wounds
most of the time

Reikenan Last Friday at 9:08 PM
ok so they're not super concerned about scratches and stuff

BSC Last Friday at 9:08 PM
most PO mechanics will say, "they're not broken enough."

Reikenan Last Friday at 9:08 PM
lol

BSC Last Friday at 9:08 PM
as long as the USPS logo, and structural integrity are intact,
it's a go

Reikenan Last Friday at 9:10 PM
I heard that they highly discourage backing up

BSC Last Friday at 9:09 PM
Correct
our scanners that we use for parcels
have GPS systems in them
that ping home base when we back up more than 50 feet

Reikenan Last Friday at 9:09 PM
Diads right

BSC Last Friday at 9:09 PM
they are accurate to within like 3 feet i think
I'm not certain

Reikenan Last Friday at 9:00 PM
you dont call them DIAD's?
i believe thats the official name for them

BSC Last Friday at 9:00 PM
Afaik no

Reikenan Last Friday at 9:00 PM
you just call them scanners then

BSC Last Friday at 9:00 PM
Not familiar with that term
correct



Reikenan Last Friday at 9:01 PM
I guess they may just be called DIAD's in UPS but they serve the same purpose

BSC Last Friday at 9:02 PM
maybe

Reikenan Last Friday at 9:07 PM
Ok i'd like to circle back to what i said at the beginning
and ask how you sort the parcels
I'd imagine its just a less crowded version of what happens in large city facilities

BSC Last Friday at 9:03 PM
are you meaning sort them in the truck? or in the office?

Reikenan Last Friday at 9:03 PM
both would be helpful

BSC Last Friday at 9:03 PM
I'll start with the office

Reikenan Last Friday at 9:03 PM
alright

BSC Last Friday at 9:04 PM
We have flatbed trailers deliver parcels in tall containers called BMCs



They arrive in these cages completely random, and unsorted
One of the other crafts in the PO is Clerk.
Clerks have the responsibility of scanning each of the parcels. Once scanned, their scanner will inform them what route it is intended to be delivered to.
they place those scanners in wire cages marked for specific routes.



From there, the carrier will take the parcels to their LLV
To understand how things are sorted

Logs 4



every address on this route is listed from first last. Left most bottom beginning, and right most top is the end.
we know where every address is located on that case starting from the left
the panels are marked A, B, C, D, etc.,

Reikenan Last Friday at 8:58 AM
so the chronology is set up from the start

BSC Last Friday at 9:58 PM
you'll notice there are 6 shelves on each panel
correct
so say i had a parcel for a customer on the 1st shelf, on the A panel
if i didn't have my scanner (i'll explain this more later), i'd get a marker, and write 1A on the parcel
so i know it comes first in the route
and load it near the front of my truck
if i have a scanner
i can scan my parcels
in an option called, "Load truck"
and it will tell me where on the route the parcel is located



the back of the LLV is numbered in compartments 1-6
1 front left
2 front right
3 middle left
4 middle right
5 back left
6 back right
so you have a system in place of how you're supposed to arrive at your deliveries

Reikenan Last Friday at 10:03 PM
this looks very similar to the UPS setup for their package cars, must be standard practice

BSC Last Friday at 10:05 PM
seems that way yeah

Reikenan Last Friday at 10:06 PM
so thats the end of the organizing?

BSC Last Friday at 10:08 PM
essentially
yers

Reikenan Last Friday at 10:09 PM
can you stand up in the back of that vehicle
or are you hunched

BSC Last Friday at 10:14 PM
i cannot.
i almost have to bend over 90Degrees

Reikenan Last Friday at 10:15 PM
do you kneel or bend?
crouch
?

BSC Last Friday at 10:16 PM
for shorter people, it's no problem
i don't kneel
crouching can work

Reikenan Last Friday at 10:00 PM
what do you do naturally i guess i mean

BSC Last Friday at 10:00 PM
oh
bend over

Reikenan Last Friday at 10:01 PM
the form of your body

BSC Last Friday at 10:01 PM
just because
it's easier to stand up that way

Reikenan Last Friday at 10:06 PM
fair

BSC Last Friday at 10:06 PM
and i can balance with my hands on the sides

Reikenan Last Friday at 10:07 PM
ok i dont wanna keep you too much longer i'll try to finish this up
have you ever had an injury or pain driven by the tasks of the job?

BSC Last Friday at 10:07 PM
No
When i was hired
I started with 3 broken ribs from a soccer injury
and i could still do the job

Reikenan Last Friday at 10:07 PM
Hmmm ~~i was almost hoping injuries would be more prominent to have cause for design~~
but alot of my research has pointed to it being less physically challenging than it appears

BSC Last Friday at 10:08 PM
the job itself
is more mental

Reikenan Last Friday at 10:08 PM
do you every feel any mental pressure to
yeah
thats what i was going to ask next

BSC Last Friday at 10:08 PM
as the weather, lack sleep, and managerial demands
are draining.

Reikenan Last Friday at 10:08 PM
lack of sleep because of work demands?

BSC Last Friday at 10:09 PM
for example
in our current time of year
My fellow workers and i are working 5AM to almost 9PM almost every day

Reikenan Last Friday at 10:10 PM
Thats a very long day! how about breaks? what do you do with them?

BSC Last Friday at 10:10 PM
eh
we are required to take a 30 minute break every 12 hours
but we often ahve too much to do to take them
so most of the time
we don't

Reikenan Last Friday at 10:11 PM
Im pretty sure that wouldnt fly in Canadian labour standards

BSC Last Friday at 10:11 PM
it techincally doesn't fly here

Reikenan Last Friday at 10:11 PM
but i imagine you'd rather just get the day done

BSC Last Friday at 10:12 PM
but
we have to do what we have to do

Logs 5



Discussion / Conclusions

Compared to having a set of questions, this interview went a lot more smoothly. Being able to move from one set of questions to another was more ideal, with loose topics. However, because it was an online interview there was a slower pace compared to verbal. It did make it easier to transcribe and review. Setting up a timeframe to complete this in would've been more appropriate.

A second point to improve on would be the clarity of the questions. There were some instances where I used unfamiliar words like ergonomics and had to explain what my intent was. Wording it out a little more would save time and perhaps provide a better answer.

Key Points

- The name of the standard postal vehicle used by USPS is the LLV, known as the Long-Life Vehicle. It has a aluminum frame that is very weak but fuel efficient. It limits its amenities to make it more cost effective and some are in service more than 30 years.
- Damages aren't much of a concern as long as the vehicle is running and hasn't damaged someone else's property.
- The RAM Promaster is better than the LLV when it comes to parcel transportation due to its size and payload.
- Turning radiuses are very important for Cul-de-sacs and narrow driveways. The drivers seat is opposite to allow access to mailboxes. Visibility is questionable and some mirrors are creating blind spots that require far stretching.
- The job isn't as physically stressful as it appears, but more mentally between the long hours and stressful demands. Breaks are hardly even taken. He loves the job but there are high demands.

Appendix iv (D) - User Operation Report

Abstract

This report is an observational study of people who work in the delivery industry. Parcels are moved with vans and various other tools, which all have the potential to be observed and find details that create pain and gain procedures a product. Observing these workers in action will help deepen the understanding of the industry workers and help create a better thesis product. The report finds procedures are very hasty in their work and have certain procedures such as pre-bagged packages for loading and the difficulty of organizing packages with little time to organize loads.

1.1 Needs Statement

The transportation of parcels is a necessary job to move goods to an individual in an efficient and comfortable manner for both the worker and the packages which should be treated with the upmost care and control (security)

The transportation also needs to be easy for the worker to manipulate the environment of the product using efficient engineering. They must feel able to act autonomously with such products and cargo.

They must have the confidence to handle loads and feel accomplished about being able to move people's belongings to those people.

1.2 Description

Parcel delivery plays a key role in today's society, and millions of parcels are being moved around the world. The tools currently used are basic and have room for improvement, which lies the purpose of this thesis topic. User observations are a step to better benchmarking current tools and processes. observation allows for external interpretation rather than biased information given during interviews.

1.3 Research objectives

The objective of these studies is to find nuances and details in the process of using tools that assist delivery. The parcel truck will be the primary tool in question. Primary objectives include identifying pain points through empathetic observation and looking for opportunities for a process to be improved. Additionally, observing the process can also reveal strengths in current methods that can be adapted to.

1.4 Key Activities

Primary activities will include a video study and live observations of experiences with parcel deliverers.

Preliminary Video Observation

Due to the nature of the job, it was considerably more effective to do the chronology and organization of data from the video analysis. The video chosen was the third of the list in section 2.1 below. This video was done in a Vlog style that felt very first person, allowing for a better understanding of what its like to be in the situation of a delivery driver.

To summarize

Preparing Vehicle with Load

Packages are preorganized into bags
Bags and packages are loosely fit into back
Cabin is stocked messily with packages
Slight crouching when inside van

Driving / Vehicle

Many packages are loose but don't seem to be falling around.
Hesitant to fully stop
Dependent on things like windshield fluid and fuel
Vehicle is borrowed from company; other people use it; rotational use

Making a Stop

Heavily multitasking when initiating a stop
Dependent on phone for GPS and tracking data (and phone battery)
Tries to make packages easily reachable / in order but isn't that easy
Has a wide range of motion that's needed from the driver's seat

Direct User Observation

The nature of this job is fairly hard to do direct user observation for. Chasing after delivery vehicles and document them from a distance isn't very effective. Because of the privacy of packages and the job, I cannot easily observe first hand. Trying to build relationships with a courier company that may allow for a direct observation is not available at this time.

Briefly observing delivery vans on the streets allows for observation but largely doesn't contribute enough information. Primary observations include them being parked in illegal spots on streets for quick-drop offs. This includes parking in bike lanes and time limited zones. There's a high stepdown for the vehicles and often very large doors on the back compared to the user's size. I witnessed no hand trucks being used for parcel delivery.

Personal experiences with deliveries being dropped off allowed for some observation as well. Vehicles often pull over on the opposite side of the road, given the direction they often come from. This puts them in danger of traffic in the environment. The driver door is in the road at that point. Area is well lit. More than often not they've already dropped off the package and are returning to their vehicle with a phone/device for tracking in hand. Rare cases you have to sign off on a delivery these days. As a secondary user of the product, I've had deliveries go missing / wrong addressed due to a similar address in the area.

User Experience

4.1 User Experience Map

Activity 1 – Loading Parcels

Laborious – organizing many materials
Ease of prep – Packages pre-loaded in bags

Activity 2 – Driving

Easy – if you enjoy driving
Multitasking – Watching GPS and all blind spots constantly while being aware of cargo

Activity 3.1 – Arrival at Stop

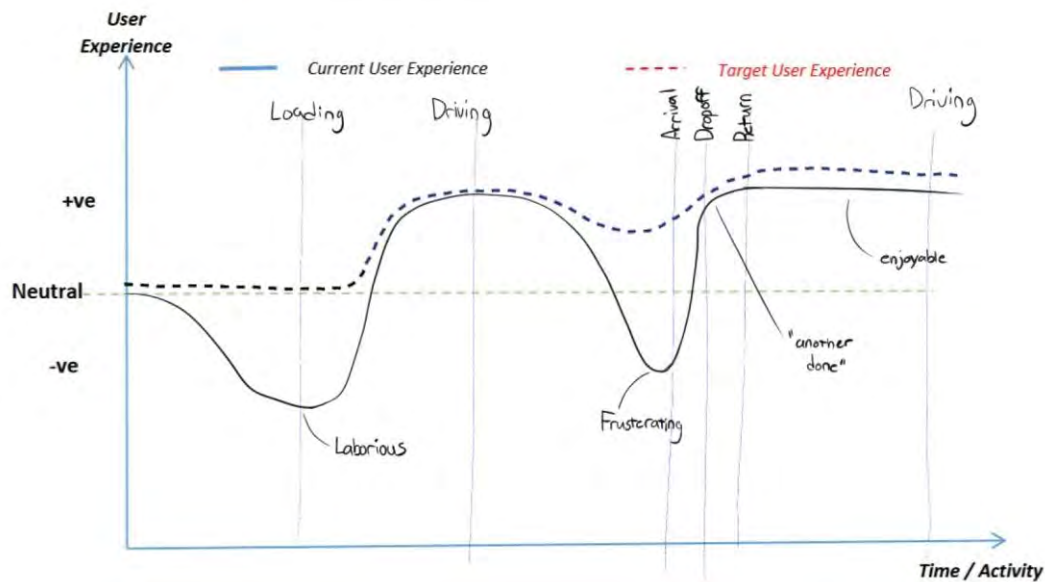
Multitasking – Crosschecking references and making sure everything is right
Frustrating – finding the package in the load

Activity 3.2 – Approach + Dropoff

Quick and easy – use of phone makes tracking easy
Interaction – may interact with people briefly

Activity 3.3 - Return to Vehicle

“Another one done!”



4.2 Potential User Experience Involvement Chart

Activity 1 – Loading Parcels

Laborious – organizing many materials
Ease of prep – Packages pre-loaded in bags

Potential to improve loading process; make it intuitive and autonomous if necessary

Activity 2 – Driving

Easy – if you enjoy driving

Multitasking – Watching GPS and all blind spots constantly while being aware of cargo

Heads up display could encourage less head shifting and assist multitasking

Activity 3.1 – Arrival at Stop

Multitasking – Crosschecking references and making sure everything is right

Frustrating – finding the package in the load

Potential to improve how they find the package through rotational storage

Activity 3.2 – Approach + Dropoff

Quick and easy – use of phone makes tracking easy

Interaction – may interact with people briefly

Potential to improve approach be eliminating and using drone technology from the seat of the vehicle?

Activity 3.3 - Return to Vehicle

“Another one done!”

Potential to improve re-entry to vehicle by adjusting the parameters of the van; door positions and forced workflows.

Overall Analysis

This observational study has helped me better understand the system that workers go through. The video analysis helped me feel like I was at the wheel of the worker, and helped detail some of the processes that I can't access in real life without getting a job in the industry. This includes the look and space of the loading bays for external companies, and the pre-bagged system that is being used. I now understand some behavioral issues such as lack of seatbelt and messy use of the cabin to try to make deliveries more efficient.

The van used, which is a standard issue class of vehicle for this job, lacks a lot of amenities that the user tried to fix through improper use of the space. Entering and exiting the vehicle isn't adapted for stop-and-go situations, and can lead to potential frustrations. Rethinking the construction of the van can solve a lot of issues.

After this report, it would be ideal to find similar videos and cross compare experiences of workers and their habits to see what is common or could fix each other's problems.

Appendix v (E) - Product Benchmarking Pool

In preparation for thesis work, benchmarking current tools used by the delivery industry is a crucial step into understanding what is available and can be improved on. This report will strictly work with road-transportation and last-mile vehicles over other tools used by parcel delivery companies. They are the center of the operation and provide information on how other tools can be used around them. Sections will benchmark benefits and features, aesthetic and semantic charts, and a keyword focus.

Benchmarking 1

Method

In the appendixes, is a collection 8 delivery vehicles, from common on-road to concept and in testing. While documents on specifications are exceptionally hard to find because of proprietary technology, a list of features and benefits was generated in point form. This section will compare various sources and find common benefits and features that drive product success. Since features are extremely variable, it will be listed as a “category for a feature / product spec”. Benefits will be summarized. Refer to appendix notes (sources) for specifics. From these focused benefits and features there we can draw common features that create a baseline.

Table

Features	Sources
Tight Turning Radius	A4, 5
Storage space relative to vehicle size	A3, 5, 6
High security and safety autonomous driving	A7, 8
Vehicle travel range to vehicle size (higher, better, electric vs fuel)	A2, 4, 6, 5,
Lightweight / specialized materials	A2, 5, 7
App empowered	A6, 7, 8

Benefits	Sources
The use of phone apps allows for easier and more convenient pickup times and routes which reduce traffic congestion and wasted fuel/time.	A.6, 7, 8
Electric powered to reduce the impact on the environment and use engine properties that work for stop-go scenarios which parcel delivery is based on. Electric powered also keeps the vehicle quiet to reduce noise pollution.	A.2, 4, 5, 6, 7, 8

Integration into urban environments, including smaller sizes to fit into compact spaces and increase maneuverability easier entering and exiting for user safety tighter turning radii highly aware sensors to prevent accidents and damaged vehicles to save money and employee reliability	A.8, 7, 6, 5, 4, 2
Modularity enabled bodies that can address many different companies needs and the transportation of a wider amount of goods.	A.8, 7, 6, 3
Objectively saving money through reduced maintenance costs, worker's time (A.8), vehicle complexity, and stop/go efficiency.	A.8, 7, 5, 2

Conclusion¹

The features common with these kinds of products are very much the same as traditional car specifications, but with an increase pressure on maneuverability. With the internet of things being more and more important, having app-empowered features are also a boon. Specific to delivery, the amount of storage it has compared to the size of the vehicle is very important. Benefits focus on the themes of ease and flexibility of use, and impact on the environment; including how they integrate with it. Interestingly enough, the traditional UPS parcel car (A.1) did not contribute to any common themes among forward thinking products. There was a lack of facts, to be fair.

Benchmarking 2

Method

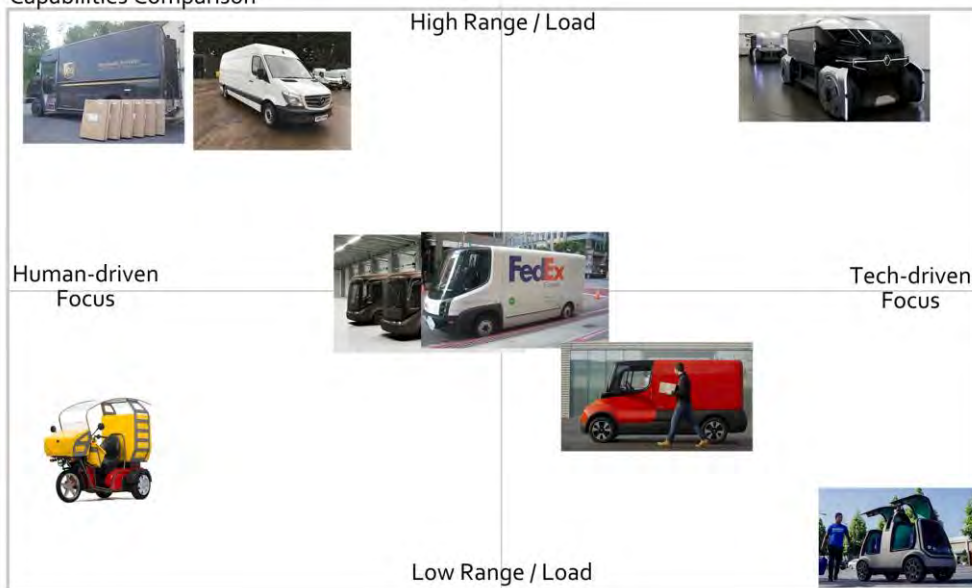
In order to compare visuals and features, setting up scatter-plot XY axis's can show a 2-dimensional visual comparison based on 2 opposing adjectives. One table will be made to show the Aesthetics, comparing the configuration of the vehicle to the size of it, because they are visual features that largely drive vehicle components. The second table will compare the capabilities of the cars, driven by the features of the range-to-load ratio to the amount of technology driven functions (over human / analogue) they have to offer. This is to discover an ideal area for function.

Table

Aesthetic Comparison



Capabilities Comparison



Conclusion¹

Aesthetically, current products are largely a traditional appearance, being a 4-wheel vehicle. More specialized cases generally stick to 3-4 wheels to retain weight loads. Many of the concept vehicles are pushing an urban-futuristic look, with smooth curved surfaces and elegant parting lines. The shape of the “box” is unanimous among products, likely encouraged by ideal space usage. Large glass window spaces give the vehicle depth and interest, while building on features. There looks to be room for a unique configuration that is somewhere between compact and heavy-load and the curvaceous shapes

that fit into the urban environment, matching the tones of its surroundings to appear integral to the city.

Within functionality, there seems to be space for a tech-driven medium range vehicle. While high range/load tech EZ-PRO (A.8) appears ideal it doesn't integrate into city streets very well by research, so trying to integrate the advantages of the Nuro (A.7) to create a balance in functionality. The use of tech-driven products seems to be very popular amongst concepts, but taking some cues from human-driven focuses such as the DXP (A.5) might create a more human-centered product.

Benchmarking 3

Method

Due to the nature of the information gathered and lack-there-of promotional information on many of the benchmarked products, it is unreasonable to do a frequency table. However, among the information and note-taking done, common themes have been reoccurring. Listing these reoccurring words / like-minded phrases will provide a pseudo frequency table that will give insight to the buzzwords of delivery service products.

Table

Top 5 Phrases/ Words	Frequency	Reasoning
Efficiency (The ability to move a maximized amount of packages with limited fuel and time used)	8	All products are advertising their ability to move product with highly capable specifications.
Urban Environment (Phrases relating the product to its place in cities, high density streets, and pedestrian filled zones)	8	All of the products have mentioned their place in the urban jungle, regardless of their true efficiency in it. Its high-density areas that have the most issues needing solving, which is also the goal of this thesis project.
Cost of Ownership / Maintenance (The prices and time involved to run a vehicle and do work)	8	All of the products mention their abilities to remain relevant and their capabilities to their point of failure. Many companies are encouraged by lower costs to their bottom line and the amount of work they can get given the time.
Electric (Electric powered motor / fuel)	6.5	Most of the products found have gone electric for the environment, and future urban trends. Even traditional UPS trucks and Sprinters are being updated.

Artificial Intelligence (The use of apps to connect products to the outside world)	5	Many of the newer products on this list talk about been “App enabled” or “Autonomous driving”. It’s a hot topic these days, and efficiencies are often being related to it.
--	---	---

Conclusion

Many of these phrases are popular buzzwords in today’s society as a whole, and apply to vehicles quite seamlessly. They’re all benefit based, but from a number’s perspective. Urban environment has the largest impact of the words to the human user, from an ergonomics standpoint. Among the top three which are all mentioned, the words of efficiency become the most repetitive. It can be embodied through many phrases, and aligns with the delivery industry. Their impact on the environment, which is always urban, stands out second most. While all products mention ownership costs, its largely tucked away because none likes seeing those numbers. All of these phrases are useful areas to investigate in-depth for their impact on the product being designed.

Discussion

All of the benchmarked data gathered points to the same themes of efficiency. Even aesthetics are driven by efficiency. While this is a large blanket term word, by comparison of other products, it means the abilities for the features to be used in a way that allows the speed of packages to be delivered and the amount that can be delivered in a period of time. The surprising lack of human consideration, that is, focus on the comfort of the user being involved, is rarely a major factor. This is where there’s an opportunity for improvement. Therefore, adding this interpretation to the needs statement could go as so;

Updated Statement of Need

The transportation of parcels is a necessary job to move goods to an individual in an efficient and comfortable manner for both the worker and the packages which should be treated with the upmost care and **using safety and efficiency technology to maximize efficiency.**

The transportation also needs to be easy for the worker to manipulate the **urban** environment of the product using efficient engineering. They must feel able to act autonomously **with changing loads over medium ranges.**

They must have the confidence to handle loads and feel accomplished about being able to move people’s belongings to those people.

Benchmarked Products

Appendix E1

UPS Package Car

Image From https://en.wikipedia.org/wiki/United_Parcel_Service

- The iconic van has seen many iterations over the years.
- Various models, hard to pinpoint information a single one (P700 is common)
- Exclusively referred to as package cars within the company
- Typical lifespan of car is 20-25 years
- Produced by Morgan Olson, Union City Body, and Utilimaster
- Lacks Radio and Air Conditioning
- Other models include P300- 1300, varying sizes in increments of 100



(Information gathered from multiple posts on Browncafe.com, a community of UPS workers who talk in online forums; firsthand experiences)

- Observation based
- Diesel and propane-based engines
- Open side door for easy access and compartment cooling options
- Utilitarian build; not constructed with user in mind. Focus on efficiency.
- Large step down
- High seat for visibility

Appendix E-2

UPS Nextgen Package Car (ARRIVAL GB)

Image From <https://www.engadget.com/2018/05/09/ups-electric-trucks-arrival/>

- The newest iteration of the parcel transport look to be fully electric with a new style.
- Concept vehicle that is to be tested in the UK with 35 units
- UPS is turning their fleet electric; included 1500 delivery traditional parcel cars being turned into battery-electric, and Tesla Semi-trucks
- Been in the works since 2016
- Build for inter-city travel, urban areas.
- Similar shape to the EStar, including lack of in-cabin doors (Appendix A.4)
- Small wheels for higher turning radius?
- Battery range of 150 miles / 240 kilometers
- "revolutionary ultra-lightweight composite materials that significantly reduce the weight of the vehicle and by combining this technology with Arrival's custom-built hardware, including power electronics and motors, the cost of operating has been reduced by more than 50%."



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(Lambert, 2018)

- Official website for the Arrival GB is very scarce on information
- Seems to be a largely hidden project

Appendix E-3
Mercedes Sprinter Van (2019, 1500)

The iconic van on the American roads today that’s the workhorse for many companies.

- Gasoline or diesel optional engine
- Active break assistance to avoid collisions
- Best in class cargo volume (15m3, 530 cuft) cargo space (which could end up being a lot of empty air space with lack of storage system)
- Best in class payload capacity
- Upfitted friendly (ability to add-on to the chassis with specialized tools, shelves, etc) > modularity
-
- Low cost ownership, payload vs maintenance costs
- Highly awarded since 2012, very prominent on today’s roads
- Wide fleet range, 15 2019 models available > options
- Image From <https://www.mercedes-benz-vans.ca/en/sprinter/cargo->



MEASUREMENTS	
Cargo Bed Length	132.9 in (337.5 cm)
Cargo Volume	319 cu ft (9 m ³)
Interior Height	67.7 in (171.9 cm)
Door Opening Height - Rear	61 in (155 cm)
Door Opening Height - Side	59.8 in (151.9 cm)
Rear Load Height	27.5 in (69.8 cm)
CAPACITY	
Max Payload	3,920 lbs (1,778 kg)
Max GVWR	8,950 lbs (3.88 t)
Max Towing	5,000 lbs (2,268 kg)
Seating Capacity	Up to 3
	Starting At \$42,900

<https://www.mercedes-benz-vans.ca/en/sprinter/cargo->
<https://www.mercedes-benz-vans.ca/en/sprinter/cargo->

(Mercedez Benz, 2019)

Appendix E-4
Fedex EV Parcel Car (Navistar Estar, formerly Modec)

Image From <https://www.treehugger.com/cars/fedex-adds-4000-efficient-delivery-vehicles-doubles-ev-fleet.html>

- Fedex’s newest van design gone electric for modern day delivery.
- 36 feet turning radius (full circle) 18feet half circle (very, very small)
- Very quiet engine, fully electric
- 100 mile range (lithium ion)
- Door is on left side (?) behind the driver cab instead of on the side
- Keyless fob
- 50mph limit, not meant for freeways (above 40mph is problem for battery powered)
- 4000-pound payload vs battery powered motor can be an issue
- 70-kilowatt (102 horsepower) motor on rear end
- Seems to go faster than it reads
- US Produced
- \$150,000 (3x more than traditional diesel parcel cars)
- Cassette style undercarriage battery that can be swapped out in 20 minutes



(Berg, 2010)

Appendix E-5**Kyburz DXP NZ (Australian Post Trike)**

Image From https://kyburz-switzerland.ch/en/delivery_vehicles/dxp_nz

- All weather trike
- Roof overtop that keeps visibility high and protection from wind and rain
- Widened undercarriage for a larger load
- Efficient safe, practical for high productivity when delivering
- Low maintenance electric motor
- Stop and go workflow ready
- Customizable to order by delivery services such as the Australian Post
- Dimensions (LxWxH) - 215 cm x 80 cm x 122 cm
- Maximum speed - up to 45 km/h
- Range - up to 115 km
- Load capacity - 120 kg and/or 270 kg with trailer
- Motor - AC 24 V / 3.5 kW peak performance
- Turning Radius - 1.8m *relation scooter 2.9m
- Batteries - LiFePo4 maintenance-free
- Climbing capacity - 30 %
- Quiet, powerful, no pollution motor
- Significantly higher payload than 2-wheeler
- Trailer optional for longer routes, easy use with 3 wheels
- Automatic parking brake
- 150% lifespan over moped = cost savings and lower environmental impact
- 3 wheels best for balance and safety in summer and winter
- Highly comfortable seat to encourage delivery worker
- Save 200-160 hours per year compared to other moped delivery routes
- Heated handle bars, lockable compartments, 124cm height, winter tires



(Kyburz, 2013)

Appendix E-6**Renault EZ-Flex Last Mile Delivery**

Image From <https://insideevs.com/news/345833/renault-announces-experimental-last-mile-delivery-van-ez-flex/>

- All new electric delivery van Renault EZ-FLEX
- Last Mile urban deliveries (150km per day on average) on single charge
- Similar to DHL Street Scooter
- Compact and maneuverable
- Optimal footprint for load space (overall size 3.86m by 1.656m by 1.88 tall)
- 4.5m turning circle
- Designed for the deliverer's
- Wide access to driver seat > ingress and egress
- Highly visible central dashboard for quick/easy info access
- Efficient driving controls
- Pedestrian and urban environment visibility
- App powered (Human Machine Interface)
- Ergonomic loading height of 760mm
- Multiple configurations adaptable
- Built for Europe
- Equipped with sensors such as "geolocation, mileage, range, use of openings, speed, stops,"
- Urban mobility of goods
- This is hoping to be a new approach for similar to gaming industry approach to improving systems
- 3m³ load capacity
- Pictures and video available at link.



(Kane, 2019)

Appendix E-7**Nuro**

Image From <https://nuro.ai/>

- AI driven drone that is currently being tested in Europe delivering groceries.
- Fully autonomous vehicle
- Built for on-road transportation of goods
- Quick, safe affordable
- Flexible interior design, handles many types of loads (dinner to drycleaning)
- “Anything, anytime, anywhere”
- No driver or passengers
- “Keep what’s outside even safer than what’s inside”
- “Safety is our top priority. More than 1 million people die in car crashes around the world every year, and 94% are the result of human error.1 Self-driving vehicles could prevent many of those accidents and save thousands of lives”
- “state-of-the-art software and sensing capabilities”
- Low speed operation (below 25mph)
- Will prioritize surroundings over contents for rare scenarios
- Materials chosen for body to reduce harm in case of accidents
- 12 cameras
- Backups for all functions
- Company developed highly aware AI; tested extensively
- Hazard lights
- “With the help of robotics, we can significantly improve people’s day-to-day lives, transform local commerce, and make our roads safer”

Pictures and video available at link.

Product booklet & Business model available at the following

link:https://static1.squarespace.com/static/57bcb0e02994ca36c2ee746c/t/5b9a00848a922d8eaecf65a2/1536819358607/delivering_safety_nuro_approach.pdf



(Nuro Group, 2019)

Appendix E-8**Renault AI EZ-PRO Concept Delivery Vehicle**

Image From <https://www.moneycontrol.com/news/technology/renaults-futuristic-ez-pro-is-a-delivery-vehicle-that-looks-like-a-lunchbox-2969381.html>

- “Groupe Renault brings its last-mile delivery vision to life with Renault EZ-PRO, an autonomous delivery concept featuring shared customizable robo-pods.”
- EZ-PRO is a field-based concierge for deliveries
- Front pod is a command vehicle, where administrative tasks are done by a non-required worker.
- AI driven
- Highly modular “robo-pods” allow for flexible shipping options, designed for many types of companies
- A large chance for disruption of the professional delivery services
- Electric LCV (Light command vehicle) (Renault’s specialty)
- Wants to be integrated into the ecosystem of smart cities
- Autonomous leader pod, driverless robo-pods. They believe that people will still need to be part of the system.
- Leader pod allows a human concierge to supervise the deliveries and services provided; instead of driving can focus on “value-added” tasks such as itinerary planning or in-person handoffs.
- Pods can be customized for the brand
- Phone application unlocked; allows the receivers to grab packages 24/7. Built with the end user in mind. Combined with apps to provide alerts.
- “EZ-PRO is part of a series of Renault concepts that focus on urban mobility services. EZ-PRO follows the introduction of [EZ-GO](#) an electric, connected, fully autonomous, shared robo-vehicle for transportation of people. With similar aspiration to bring sustainable mobility for all, EZ-PRO is 100 % electric contributing to a **greener and quieter transport system.** “



Concept vehicle. Many features haven’t been given due to the nature of the design stage.

(Farissier, 2018)

Appendix vi – CAD Models

All images were included in chapter 4.

Appendix vii – Hard Model Photographs

All images were included in chapter 4 and 5.

Appendix viii – Technical Drawings

All images were included in chapter 5.

Appendix ix – Manufacturing Cost Report

Report was never assigned for acknowledged. Cost breakdown and estimates are included in chapter 5.

Appendix x – Sustainability Report

Abstract

Products in today's design landscape need to be considerate of the materials they consume and how well they are used to achieve goals relative to the impact on its surroundings. Benchmarking standardized vehicle manufacturing practices and observing specialized vehicles such as package cars yields considerations for a final design. The final design must be adaptive to improving technology and rely on urban surroundings to create a new workflow that enables more efficient use of the vehicle both on a macro (workflow) and micro (material) level. Manufacturing methods have an opportunity to be specialized in low batch large-scale equipment, allowing for modification, upfitting, repair and durability while retaining comfort, aesthetics, and ease of use. This combined with unique automotive packaging will be critical for a product that's impact and efficiency is the epitome of its profit.

Keywords: Sustainability, Environmental Impact, Materials and Manufacturing, Transportation, Design

Internals of this report were added to the main chapters of this thesis.

Conclusion

The sustainability of this project proves its viability in the actual world as a product that will alleviate the transportation sectors impact on the environment while making use of its surrounding man-made landscape to its advantage until traditional cargo vehicles. The use of lighter materials and modular components keep repair and maintenance easy for the end user and increases the life of the vehicle. Using modern breakthroughs in AI, Autonomous driving, and electric propulsion systems grants the vehicle a rite of passage to inevitable upcoming standards.

Appendix xi – Topic Approval Form

Humber Institute of Technology & Advanced Learning
School of Applied Technology
Bachelor of Applied Technology – Industrial Design
Winter 2020
iDSN 4502 Senior Level Thesis Project II
Dennis L. Kappen/Catherine Chong/Sandro Zaccolo

THESIS DESIGN APPROVAL FORM

NAME

Evan Demczuk

TOPIC TITLE (Brand)

Metropolitan Parcel-Vendor Distributor

“Consign”

Thesis design is approved to proceed for the following:

CAD Design Phase

Rapid Prototyping and model building phase

COMMENTS:

Signed


Catherine Chong / Dennis L. Kappen

BIND 4502 Design Thesis 2 – 2020

THESIS TOPIC DESCRIPTIVE SUMMARY (Write this in the same way as you would write an abstract – past tense)

Student Name
Evan Demczuk

TOPIC TITLE

“Consign”
Metropolitan Parcel-Vendor Distributor

ABSTRACT

The delivery industry has been the backbone of industries all over the world, and significantly increased with the advent of digital commerce. Many companies continue to use transports that rely on manual labor that is becoming progressively intensive which has put strain on these systems. To assist the parcel handlers and accelerate company commerce, this thesis project was developed as a solution to the urban transportation of parcels. User and industry studies inform ergonomic workflows, alternative methods of delivery, organization, security and awareness. The culmination of these factors has led to a compact transportation vehicle capable of deploying curbside vendors and other cargo packages to reduce manual labour and save resources including time.

Ergonomics focused on a concept canopy with a standing-leaning drivers' seat. The application of autonomous operation was also explored in an industry excited by its potential. The harmony of these elements created a user-centered delivery system to benefit a large connection of users.



Appendix xiii – Other Supportive Data

F-1 Research Approach Report

Abstract

In order to design for a thesis project on parcel delivery in urban areas, one must have a plan to research the user who they are designing for. To know the capabilities of a person, and what they do. Using strong techniques like creating relationships with users and analyzing their movement and patterns to better understand them engages the foundation for design. As equally important, its key to understand the ins and outs of benchmarked products to allow the room for both revolution *and* evolution to make progressing in a seamless manner that focuses on the user rather than their objective exclusively (in this case, a parcel!)

Keywords: Research, Method, Design, Innovation

Research Approach Report

In order to design for a thesis project, it's required to think on an innovative level inspired by users. This report will explain research methodologies that will be applied to this thesis project created to improve the workflow of parcel delivery in urban environments. Elaborating on the teachings of Kelley, Plowman, Winsor, and McLoone, can explain the proper approach to designing with the user in focus.

User Research

This section introduces the user's needs and how research should be done to address the users personality and demographics to create an inspired product to assist them with a job. Developing a strong profile can drive the reason for this project.

1.1.1 User Profile/Persona

The user is the center of any design project. The primary target market for this kind of product would be a Parcel Deliverer. This kind of user doesn't have a caregiver. They are used by companies as a cog; and here lies a chance for innovation. Kelley expresses the advantages of a caregiver. Comparable to a doctor, who's the "purest form of a caregiver", a delivery worker has the chance to be an effective caregiver to products being delivered. It's in their hands to treat your parcel as a doctor would a patient. The objective is to make the user of a new tool feel as if they're empowered to be a caregiver. As a designer, we want to be a caregiver to these people, and design a product that is tailored to their needs. Current products focus on the package, and wanting to get it from one place to the next, but doesn't help the deliverer out in a personalized manner. The goal is to not change the end goal, but the way it is delivered. This is comparable to the "baseball cards" that IDEO and the DePaul team used to create a more personalized environment which encourage more positive setting (Kelley 2005). This in turn, encourages the caregiving of products and a more positive experience for the receiver of a product.

1.1.2 Current User Practice

Current practices of these users are very efficient but only for the objective of getting a package to the receiver. Many deliverers are relatively happy with the job, but can be subject to both security and physical risks when pushed on long shifts of constant movement. Understanding these scenarios and the common things that make up the daily tasks will allow the design to form to already active practices. It's important for designs that have new methods to be familiar in some way. Winsor encourages this idea through "co-creating with customers to exceed their expectations". As a designer we want to drive what people want through what they want. This circular feeding is what creates inspiration that surprises and excites. (Winsor 2006) To apply this to a delivery tool, we must take practices and common "life hacks" that users might create and derive new meaning from them to inspire them to be happier workers.

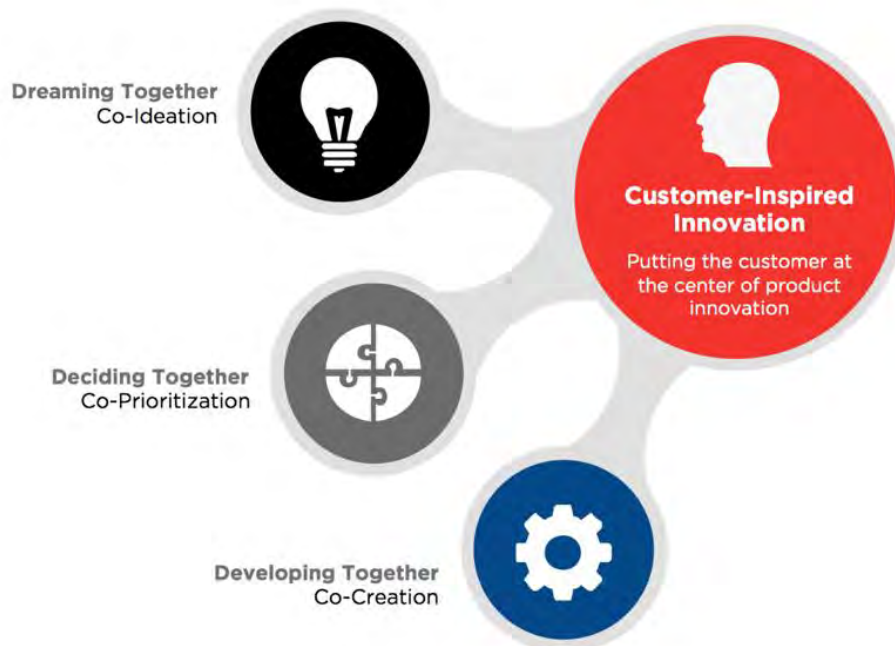


Figure 6 Customer Inspired (Lillie 2018)

1.1.3 Activity Mapping

In order to map the user's patterns, it's important to use ethnography to watch the users and be inspired. The best method of ethnographic research of people who move product is to watch them move product. While preferably done in person, to be able to ask questions and understand their habits, videos are significantly more available. Users have made Vlog style videos which can show the day in the life of these users. As used by a method created by McLoone and co, this information is then deciphered for patterns, insights, and obstacles which help inspire new ideas. Though it is also stated that "In addition to evaluations of mere behaviors, the hope is that aspects of users' needs and motivations can be discerned". These underlying motivations are key in understanding the moods and drive of the users, and can be crucial in creating a successful revolutionization of a workflow and opening new opportunities for brainstorming of functionality.

Plowman's (2003) article has a strong stance on the importance of ethnography. Studying real people rather than theorizing allows us to better analyze artifacts in use, and how people will adapt them to their surroundings. De Certeau, a researcher he studied, believed that every person is a

producer of a lifestyle, and through lifestyle they developed new uses for objects, transforming them, and creating opportunities, which loops back to Windsor's co-creation.

1.1.4 Ergonomic Research (Existing Products)

People are different, and come in many shapes and sizes. Rather than exclusively decided sizes through theory, we can see how many people adjust to currently made products and their ergonomic considerations. The reach people have, the adjustments they make, the additions to a space or a product. By observing people and setting up ethnographic studies, it's important to acknowledge every movement people make in benchmarked products. As mentioned by Certeau, a person creates a method around an artifact (Plowman 2003), and those adjustments to comfort them are key to making a product for them.

1.2 Product Research

In contrast, it's important to benchmark the product itself and what it has to offer the user. While they can go hand in hand, the details are much different. Understanding what current and upcoming products succeed it are precautions to not take steps backwards. Understanding the benefits and specifications, functionalities, appearance, materials, and sustainability are all important aspects of creating a product that is to be used.

1.2.1 Benchmarking –

Benefits and Features.

Benefits are the clear qualitative aspects of a product that drive a user to want to use the product. Benefits are best realized when you can see a product in action, rather than relying on theory. Features are often broken down into specifications that can be quantified. It's rather easy to compare and is often driven by technology. By successfully mapping out and comparing the features of existing products to create "metrics to elucidate strengths and weaknesses of current products" which host the ability for a product to do its job; and what limitations may occur. (McLoone 2015).
Functionality

In research, discerning the strengths and weaknesses of currently used products (McLoone, 2015) is critical to help weigh new designs against their chance of failure. Understanding their function and how well they execute that function ultimately contributes to a products success or failure. To avoid failure, we need to adapt the user's likes and dislikes already determined and find which products better

fit the user and adapt those functionalities. In places of failure, we need to propose new ideas that may be enhancements or radical changes in order to innovate.

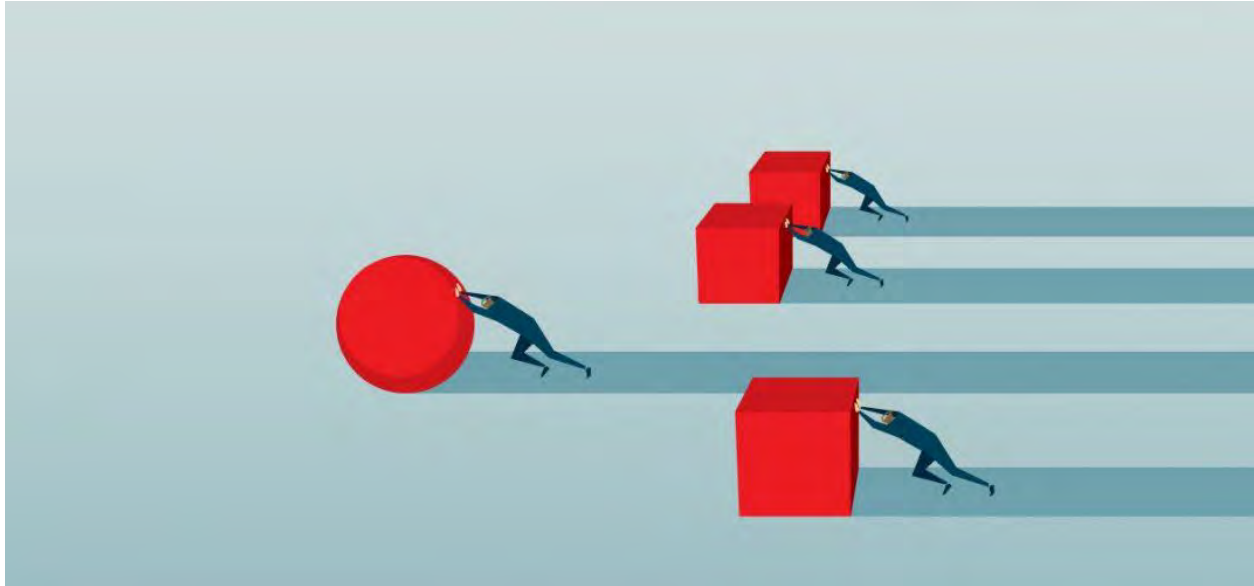


Figure 7 User Objectives and Innovation (Levchuk 2017)

Aesthetics and Semantic Profile

To better understand the aesthetics of these kind of tools, its good to review the concepts of both current and futuristic ideas. Since modern day tools are very utilitarian, its best not to weight to much on them but still understand the key consistencies with what makes a delivery product recognizable as that tool; what authority it has. After evaluation and cross comparing products, using “semantic differentials (i.e., paired adjectives)” are an effective way of conveying different semantics (McLoone, 2015). These word pairs allow for easy designation of attributes such as “appearance, context of use, performance, functionality, and brand”. This will allow consistent design language to be easily communicated through the design while leaving room for aesthetic freedom.

Materials and Manufacturing

With such a wide range of materials available, its important to discover resources that may be able to inspire a new benefit to the user. Finding products not only exclusive to delivery but rather built for single functions may help inspire new materials to bring into the theme of the thesis topic and drive new ideas. Manufacturing is much the same, starting with the benefits of a product created through unique manufacturing and how that could be applied to a new field.

Sustainability

In a similar vein to materials and manufacturing, its important to know what is a responsible use of material, and not using excessive amounts of it. Looking for techniques benchmarked in many products that have similar functions (such as trucks or lightweight elderly gear) may drive the use of less materials and better consideration for fuel usage and strength required, driving benefits to ease a customer and the products impact on their world.



Figure 8 Parcel Delivery in Japan (Muramatsu 2017)

Conclusion

Information about your user will ultimately drive every last decision in the project, so its wise to understand the relationship between functionality and features and how they assist that person create a better lifestyle. Parcel delivery is a sector that doesn't see enough concern for their workers than they do their packages, and there's a chance to innovate because of the lack of reflection of their style they've created, and a lack of care. While functionality is very strong, it focuses the product, not the person, which, by many authors belief, is against the core of design. Let this project change that.

Image References

Figure 1

Lillie, B. (2018). Retrieved from <https://blog.equinix.com/blog/2018/12/17/turn-to-customer-inspired-innovation-to-create-winning-products-and-services/>

Figure 2

Levchuk, K. (2017). Retrieved from <https://kategoestech.com/2017/08/16/on-innovation-stagnation-and-growth/>

Figure 3

Muramatsu, Y. (2017). Retrieved from <https://asia.nikkei.com/Business/Japan-s-delivery-job-wages-soar-ahead-of-holiday-season>

F-2 TCPS2 Core Certificate

**PANEL ON
RESEARCH ETHICS**
Navigating the ethics of human research

TCPS 2: CORE



Certificate of Completion

This document certifies that

Evan Demczuk

*has completed the Tri-Council Policy Statement:
Ethical Conduct for Research Involving Humans
Course on Research Ethics (TCPS 2: CORE)*

Date of Issue: **1 October, 2019**

F-3 Ergonomics Study

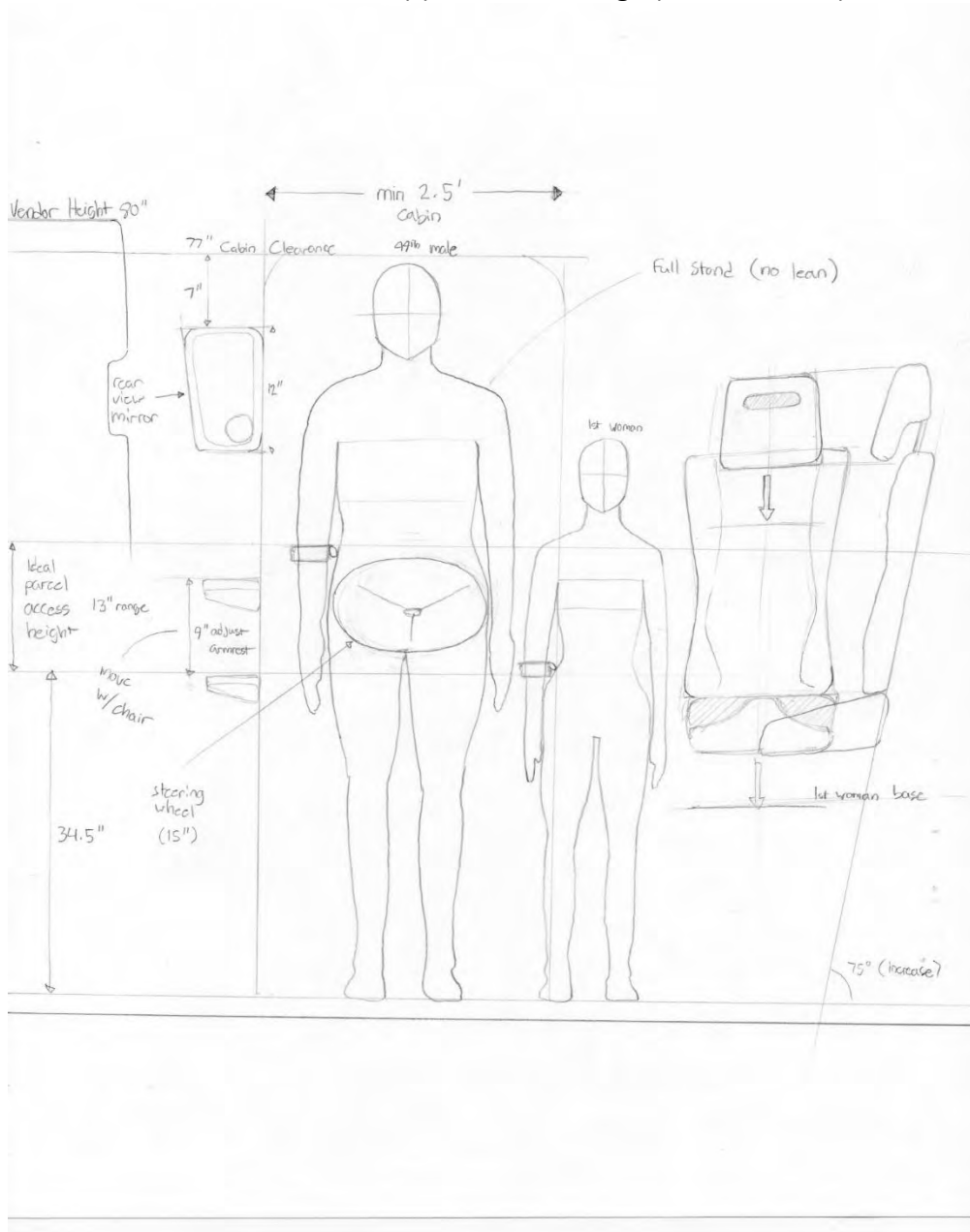
Description of User Observation Environment Used in this Study

User observations were done in a home garage using the ergonomic buck created. Studies of currently used vehicles/benchmarking is provided by video evidence and dimensional readings of sources in the *benchmarking* section of the Thesis Report.

Location and Timeframe

Date of Observation(s): January 5th 2020 (Observation 1)

Location of Observation(s): Home Garage (Observation 1)





Ergonomic Buck (Lowered Seat Angle, Lowered Headrest)



Ergonomic Buck (Low) with 5' 6" Male

F-4 Sample Consent Forum



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October 9th 2019

Industrial Design Thesis - Urban Parcel Delivery

Parcel Delivery Employee Interview Consent Form

This consent form will allow me to ask questions and utilize your answers in my thesis project about your experience in the parcel delivery workplace. You may feel free to decline any questions or withdrawn if you feel the need to do so.

I, (please print) _____, have carefully read and understood the Information Letter for the project Urban Parcel Delivery, led by Evan Demczuk. A member of the research team has explained the project to me and has answered all of my questions. I understand that if I have additional questions about the project, I can contact Evan Demczuk at any time during the project.

I understand that my participation is voluntary and give my consent freely. I also understand that I may decline or withdraw from participation at any time, without any penalty or any explanation.

In understand that I can verify the ethical approval of this study, or raise any concerns I may have by contacting the Humber Research Ethics Board (Dr. Lydia Boyko, REB Chair, 416-675-6622 ext. 79322, lydia.boyko@humber.ca), or Evan Demczuk.

My signature below verifies that I have received a copy of the Information Letter, and that I consent to participate in this study:

Participant's Name (printed)	Participant's Signature	Date