ROAM

Explore. Adventure. ROAM.

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Industrial Design Thesis Report

Off-Road Ecotourism in Canada

by

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Abstract

This project begins with the task of addressing the ecological degradation associated with off-road ecotourism and overlanding in Nova Scotia. The overarching issue not only poses a threat to the region's ecosystems but also undermines the sustainability of the tourism sector, vital to Nova Scotia's economic prosperity. Rooted in the intertwined principles of environmental preservation, economic stability, and the protection of Nova Scotia's unique natural heritage, the challenge demands a comprehensive approach. Accordingly, the research endeavors to synthesize insights from diverse disciplines, notably tourism management, to devise an innovative solution. Central to this endeavor is the development of an environmentally conscious off-road experience that upholds ecotourism principles. This aligns with broader objectives of fostering responsible tourism, safeguarding biodiversity, and nurturing conservation awareness. To address this challenge, ROAM (Remote Off-Road Amphibious Mobility) is a sustainable off-road camping vehicle for ecotourism. This solution provides not only a different and unique perspective to spending time in nature, but also promotes sustainable practices. This approach is focused on creating an eco-friendly off-road vehicle, aligning with the larger goal of promoting responsible tourism, preserving biodiversity, and raising awareness about conservation. ROAM includes unique features that separate it from existing options, allowing people the opportunity to experience nature for longer periods of time in comfort while exploring nature in a vehicle that has a reduced environmental footprint. The future findings of this study will offer invaluable insights into the effectiveness of sustainable off-road ecotourism practices. These insights, derived from the evaluation of specific design solutions and their consequences, will serve as a linchpin in guiding Nova Scotia towards an environmentally conscious and economically resilient future.

Keywords: biodiversity, economic prosperity, ecotourism, environmental impact, environmental preservation, sustainability, sustainable practices, tourism sector

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CHAPTER 1: INTRODUCTION

1.1 Problem Definition

Off-road ecotourism and overlanding in Nova Scotia face many challenges demanding innovative solutions for sustainable practices and enhanced visitor experiences. Through a comprehensive problem-finding process, it became evident that existing off-road vehicles and camping setups lack integration for sustainable practices, leading to increased environmental impact and compromised experiences. This problem encompasses functional deficits in off-road vehicles tailored for sustainable camping experiences, insufficient environmental consciousness, and the absence of adequate facilities that minimize ecological footprints. The significance of addressing these issues lies in preserving delicate ecosystems, reducing carbon footprints, and promoting responsible tourism practices. The identified needs call for a multifunctional off-road vehicle that not only navigates diverse terrains but also serves as a sustainable living space, seamlessly integrating eco-friendly features. Expert interviews within the ecotourism, automotive design, and environmental conservation fields, along with surveys targeting potential users, have provided crucial insights into the essential elements required in an ideal off-road camping vehicle and highlighted the expectations and preferences of ecotourists and off-road enthusiasts. Thus, the fundamental aim of this thesis is to design a vehicle that effectively bridges these identified gaps, promoting sustainable off-road experiences while minimizing environmental impacts in Nova Scotia's ecotourism landscape.

This design project research confronts the challenge of mitigating ecological degradation coming from off-road ecotourism and overlanding in Nova Scotia. This underlying issue not only puts the region's ecosystems at risk but also jeopardizes the long-term viability of a tourism industry central

to Nova Scotia's economy. At its core, the problem intertwines environmental preservation, economic stability, and the safeguarding of Nova Scotia's distinctive natural heritage. To address this challenge, the research promotes a comprehensive design approach that combines various fields, such as tourism management. This approach primarily centers on the development of an environmentally friendly off-road experience aligned with ecotourism principles. This initiative aligns with the broader goal of promoting responsible tourism, conserving biodiversity, and increasing awareness about the importance of conservation. The research plan entails collecting data through surveys and interviews with experts. Both quantitative and qualitative research methods will be employed to gain a deep understanding of this multifaceted issue. Looking forward, the findings of this study will offer valuable insights into the effectiveness of sustainable off-road ecotourism practices. The assessment of specific design solutions and their consequences will play a pivotal role in guiding Nova Scotia toward an environmentally conscious future.

1.2 Rationale & Significance

This design project goes on a comprehensive exploration aimed at revolutionizing off-road ecotourism and overlanding practices in Nova Scotia, emphasizing a conscientious approach. The inquiry dives deeply into discerning the pivotal factors influencing the sustainability of overlanding and off-road ecotourism, particularly addressing the shortcomings prevalent in current off-road vehicles and camping setups. Key information searched consists of a nuanced understanding of the ecological and environmental impact of off-road vehicles, consumer preferences for sustainable travel, and any technological advancements conducive to eco-friendly transportation solutions. The fundamental inquiries guiding this exploration center on pinpointing the essential components required to design an off-road vehicle that not only promotes thrilling adventures but also prioritizes sustainability. The investigative approach integrates multiple methodologies, including detailed user

and product research, data analysis, and an evaluation of anticipated benefits. This approach not only aims to comprehend the unique needs and desires of tourists and off-road enthusiasts but also strives to describe the potential environmental, economic, and societal benefits of a sustainable off-road vehicle. Through this research, the objective is to craft a complete understanding that informs the design and development of a multifunctional vehicle to redefine off-road ecotourism in Nova Scotia.

1.3 Background / History / Social Context

The Government of Canada (2023) found that walking, which is also one of the most popular things to do in nature was the top outdoor activity reported by three of four (74%) of Canadian households, while hiking and hitting the trails was reported nearly 3 in 10 (29%). The landscape of off-road ecotourism in Nova Scotia is significantly influenced by a junction of broad-ranging trends that cross various domains. Demographically, there's a notable shift in traveler preferences, where an increasing number of adventurers seek immersive experiences that connect them with nature while ensuring minimal environmental impact. Simultaneously, lifestyle trends reflect a growing inclination towards sustainable living and eco-conscious choices, fueling the demand for off-road adventures that align with these values. This shift is further compounded by media trends, with social media platforms amplifying the allure of off-grid adventures and sustainable travel, thereby catalyzing interest in off-road ecotourism. Simultaneously, there's a pronounced trend in product design and innovation, where the emphasis is on creating vehicles and camping solutions that harmonize adventure with environmental responsibility. These collective trends paint a compelling picture, underscoring the growing significance of sustainable off-road experiences in Nova Scotia's ecotourism landscape.

CHAPTER 2: RESEARCH

2.1 User Research

Understanding the target users is fundamental in shaping the development of an effective off-road living solution. The preliminary survey results and user interviews conducted provided significant insights applicable, such as off-road vehicles featuring all-wheel drive, locking differentials, or both is extremely useful when traveling off-road across various rugged terrains (40% of participants mentioned these features were important). These features were deemed crucial for enhancing the vehicle's off-road capabilities, ensuring stability and traction across diverse and challenging terrain. While vehicles lacking these features could still perform adequately, the integration of all-wheel drive and locking differentials significantly elevates a vehicle's off-road performance and maneuverability, contributing to a safer and more confident expedition for adventurers and enthusiasts engaged in ecotourism. This insight suggests an opportunity to incorporate all-wheel drive, locking differentials, or both into the design of a vehicle for off-road ecotourism, aligning with the preferences of adventurers and enthusiasts that are engaging in ecotourism.

Also mentioned was the importance of safety gear, along with satellite communications for emergency situations. Survey findings also underscored the importance of safety gear and satellite communications as pivotal components in emergency situations during off-road travel and extended days in the outdoors. Individuals engaging in off-road ecotourism expressed the necessity of having adequate safety measures and reliable communication tools to address potential emergencies effectively. Integrating these features into the design of an off-road vehicle ensures an added later of security and peace of mind for adventurers and overlanding enthusiasts exploring remote terrains, aligning with their safety concerns and emergency preparedness while promoting a sense of confidence and assurance during their adventures.

These insights from survey data along with user interviews offer crucial design considerations for creating off-road vehicles that are specifically tailored to ecotourism and overlanding in Canada. Incorporating these features into the vehicle design ensures enhanced off-road capabilities, prioritized safety measures, and effective communication tools, contributing to a holistic and secure ecotourism experience for individuals when in diverse and challenging terrains.

There were a couple of interviews that were conducted as part of this research report. These interviews were conducted with individuals that live in Nova Scotia, the main area of focus for this thesis project.

The interviews were quite helpful into what the landscapes in Nova Scotia were like and what modes of transportation are used most. Both interviewees mentioned that the province has a variety of different terrains, including coastlines, valleys, forests, and more. Interviewee #1 spoke about how camping has gotten quite popular over time, with many different campsites to be found all over Nova Scotia.

Interviewee #2 spoke about their childhood, how growing up he would spend a lot of his youth backwoods fishing, snowmobiling on frozen lakes, and especially camping. Most of the activities he was involved in involved the waterways in some form, as the sheer number of waterways is a unique feature that the province has. A challenge that he also mentioned was navigating some terrain. Two of the main challenges that he mentioned when it came to navigating off-road in Nova Scotia were with waterways that do not have crossings, and the dense undergrowth. “Unlike Ontario’s Carolinian Forest that has many tall trees and a fairly thin undergrowth, Nova Scotia has Acadian and Boreal Forest with thicker undergrowth, making even walking a slow process.” These insights emphasize the unique environmental characteristics of Nova Scotia's terrain, highlighting the intricacies and difficulties encountered when navigating off-road landscapes. These challenges require specialized solutions and considerations in vehicle design or ecotourism planning to address the specific

obstacles posed by the absence of waterway crossings and dense undergrowth. Strategies focusing on overcoming these obstacles are crucial for facilitating safe and efficient exploration of Nova Scotia's off-road terrains during ecotourism activities.

2.1.1 User Profile – Persona

Primary User	Secondary User	Tertiary User
25-60yr old Tourists and Visitors	25-50yr old Tour Guides/ Operators	Educational Institutions
- Varies from young adults to seniors - Enjoys exploring new places and seeing new things - Education varying from high school to higher education - Exploring the wilderness and experiencing nature - Comfortable travel - Unique and memorable experiences - Navigating in rugged terrain (safety concerns) - Accessible amenities and emergency support	- Lead tours - Ensure guest satisfaction - Organizes route(s) for tours to take place - Sharing knowledge about the area/ province - Ensuring guest safety and environmental conservation - Managing group dynamics, unexpected situations - Interests in ecological preservation, sustainability, storytelling	- Varied students and educators - Professors, students, researchers - Higher education and/ or research oriented - Enhancing educational experiences through ecotourism - Educational tools, sustainable practices - Aligning academic goals with fieldwork - Maintaining sustainability, educational value - Field trips, research expeditions

Table 1: Primary, Secondary, Tertiary Users

This thesis project is specifically looking at the age demographic of approximately 25-60 years. This demographic is directed more towards the younger ages, being that there are not many tourists or adventurers closer to 60 years old that are going on off-road ecotourism excursions or going overlanding.

Primary User Persona

Name: James Smith

Age: 29

Job: Software Developer

Net Wealth: ~$80,000

Education: Bachelor's Degree in Computer Science

Status: Single

Location: Lives in Toronto, Canada

Group/ Solitary: Prefers traveling in a small group with friends to share experiences

Other Activities:

- Trying new foods
- Traveling and experiencing different cultures
- Photography

Profile

James is 29 with a bachelor's degree in computer science living in Toronto, Canada. He is single and enjoys working out, doing photography during his spare time and loves to travel, experience different cultures and see new things.

User Behaviour

James is a tech-savvy individual with a keen interest in software development and technology. He values staying physically active and maintains a routine by trying to work out twice a week. His enthusiasm for exploring new cultures and traveling reflects his adventurous and open-minded nature. James prefers traveling with a small group of friends, enjoying shared experiences, and fostering camaraderie during his trips. His hobby of photography allows him to capture and document memorable moments during his travels.

Relationship with Ecotourism/ Overlanding

James' interest in exploring different cultures and trying new foods aligns with the essence of ecotourism, which involves immersing oneself in diverse environments while practicing sustainability and respecting ecosystems. While his primary focus might not revolve around eco-centric travel, he values authentic experiences and might appreciate overlanding to access remote areas, witness unique cultures, and capture diverse landscapes through photography. His preference for group travel could extend to overlanding trips, fostering shared experiences while exploring off-road terrains in the company of friends.

Figure 1: Persona

2.1.2 Current User Practice

Currently, within the realm of off-road ecotourism and overlanding, users commonly engage in a set of routine tasks and demonstrate specific attitudes. Tasks can include vehicle preparation, route planning, and gear checks before setting off on off-road journeys. Users exhibit a methodical approach, prioritizing vehicle maintenance, safety measures, and environmental conservation. Attitudes are aligned with responsible travel, emphasizing respect for natural environments, appreciation for local cultures, and a commitment to sustainable practices. While following routine preparations, users also embrace non-routine tasks, valuing the spontaneity in exploration. These tasks might involve impromptu detours to discover hidden or more remote trails, spontaneous wildlife encounters, or unplanned stops for capturing breathtaking landscapes. Attitudes can include flexibility, welcoming any unforeseen adventures, and fostering cultural immersion during travels. The user experience in off-road ecotourism and overlanding is significantly shaped by contextual factors encountered during travels. User attitudes and approaches dynamically respond to diverse contexts, involving adaptable strategies to navigate varying terrains and engage with local communities. Currently, vehicle choices for off-road living often include road vehicles that have been modified or tailored for overlanding or vans that have been converted into mobile camping units. However, existing options lack seamless integration and compactness compared to larger vehicles. While modified road vehicles offer off-road capabilities, they might lack the comprehensive living features necessary for prolonged off-road stays. Vans converted into campers provide living spaces but may not offer off-road performance making the vehicle capable for rugged terrains. There's a gap in the market for a compact off-road vehicle that seamlessly integrates off-road capabilities with comfortable living amenities for sustainable and convenient off-road ecotourism experiences.

Insights from interviews, surveys, and online discussions highlight the current challenges faced by users due to limitations in available vehicle choices. Users encounter difficulties in locating vehicles that effectively merge these features without requiring extensive modifications, being extremely large, and making a user's experience easy and straightforward. The predominant package and lack of compactness in available options also poses challenges, especially for navigating through rugged terrains or seeking maneuverability in tight spaces in remote areas during adventures. Some vehicles used for overlanding or camping lack comprehensive off-road features, constraining their usability when encountering challenging landscapes typical in ecotourism adventures. While camper vans or modified vehicles offer living spaces, they might not entirely align with users' desires for a seamless and comfortable integration of off-road capabilities and sustainable living. Some of the most vehicles that have been deemed the best vehicle for overlanding are pickup trucks (Jaynes, 2023), providing off-road capabilities as well as having the potential to be used for camping, but they have limited living space which requires additional modifications for comfortable living, as well as fuel efficiency, impacting the environment contributing to a higher carbon footprint and increased emissions. Pickups trucks or vehicles in general also tend to make more noise, serving as a significant disturbance to animals and their habitats in many areas (Buckley, 2009, p. 135). The market gap for a more compact and integrated off-road living solution that seamlessly combines off-road capabilities with convenient living amenities remains, frustrating potential users seeking comprehensive yet compact options for off-road ecotourism and overlanding. Addressing these challenges is essential to enhance user experiences and promote sustainable, integrated solutions for off-road enthusiasts.

2.1.3 User Observation – Activity Mapping

Observation Setting:

1. Location: A designated area where the user prepares their vehicle for the off-road camping adventure. This could be the user's home, a garage, a parking lot, or a camping gear staging area.

2. Time: The observation occurs during the period leading up to departure for the camping trip. It might span from a few hours before departure to the final moments before the user drives off.

3. Equipment: Observational tools might include notepads, cameras, audio recorders, or video cameras to document the user's activities, packing methods, and interactions with the vehicle and camping gear.

Step 1

Making a List

1. Highlighting the need to consider additional items other than essentials such as recovery gear and water solutions when overlanding as opposed to regular camping.
2. Possibly packing other useful terms such as a folding table, garbage bags/ something to dispose garbage into, etc.

Points of contact:

3. Inventory Check: Creating that main list listing everything from camping gear, food supplies, tools, etc.
4. Packing Strategy: Noting the approach taken by the user to organize gear, categorize items, and plan their placement within the vehicle/ storage compartments.
5. Vehicle Inspection: Conducting a pre-trip vehicle check, including fluid levels, tire pressure, and making sure the vehicle is in optimal condition for off-road travel.

“Leave no Trace”

Step 2

6. When camping, there are usually dump sites for campers to dispose of garbage, but when overlanding and being in more remote locations, “leave no trace” is a rule that is usually known by more people who are experienced overlanders. Essentially meaning pick up and take all garbage with you and leaving the grounds the way you found them if not better. So, preparing and packing a product such as a “trasharoo” or similar is important to take garbage with you with ease.

7. User is forced to bend their back and knees, so they don’t hit their head on the exterior of the cab.

Step 3

Packing Execution

8. Sleeping arrangements within vehicle, observing, and keeping user's preferences for comfort and convenience in consideration.

9. Observing user's organization of kitchen/ related supplies, including cooking utensils, stove setup, food storage, meal prep procedures, etc.

10. Paying attention to storage optimization, utilization of compartments and storage solutions, and ensuring easy access to frequently used items.

Final Preparations – Last Minute Adjustments

Step 4

11. Making any last-minute adjustments or additions to packing arrangements based on situational requirements, or changing needs.

Step 5

Safety Checks and Emergency Equipment

12. Observing the user's preparation of emergency kits, first aid supplies, communication devices, and safety equipment (ensuring additional preparedness for any possible unforeseen situations).

Departure Readiness

Step 6

13. Documenting any final checks/ preparations of packing before officially leaving to go overlanding and off-road living.
    - Will provide comprehensive insights into the user's planning, organization and execution of preparations for extended camping excursions.

Figure 2: User Activity Map

2.1.4 User Observation – Human Factors of Existing Products

Current products typically prioritize ergonomics tailored to younger adults. However, as individuals age, their body size tends to diminish. Therefore, it is essential to consider the ergonomics of older individuals as well. Some examples of existing products that offer some insights into ergonomics include vans, Sports Utility Vehicles (SUVs), and All-Terrain Vehicles (ATVs).

2.1.5 User Observation – Safety and Health of Existing Products

Road vehicles adapted for ecotourism or overlanding can undergo modifications to strengthen their off-road capabilities, which involves careful attention to safety and health concerns. These modifications, while enhancing a vehicle's performance in rugged terrains, introduce specific safety considerations. Raised suspensions and larger tires, while improving off-road traction, can impact stability, potentially raising the risk of rollovers on uneven surfaces. Ensuring proper vehicle stability through roll cages or reinforced structures becomes crucial to mitigate these risks. Additionally, off-road driving demands some skill, making maneuverability when driving essential to navigate challenging terrains safely. Vehicle inspections are imperative to assess the impact of modifications on various components of a vehicle, preventing potential failures during off-road expeditions. Equipping the vehicle with emergency gear such as first aid kits and communication devices is critical for handling any unexpected situations. On the health front, focusing on ergonomic interior design to ensure comfortable seating, adequate space, and proper posture support becomes important for preventing fatigue during extended journeys. Addressing environmental factors by ensuring proper food storage, hydration, sanitation, and rest is essential for maintaining physical health while in the outdoors for extended days. In addition, considerations for air quality through

effective ventilation or filtration systems and prioritizing mental well-being by creating a supportive interior space are important to sustain a safe and healthy off-road experience. Balancing these safety and health considerations is crucial for optimizing road vehicles for the demands of ecotourism and overlanding adventures.

2.2 Product Research

With off-road ecotourism, conducting thorough product research is important to understanding current trends and identifying opportunities for innovation. This section goes into an exploration of existing products and trends through a multifaceted approach. Through benchmarking analysis, interviews, surveys, and engagement with online communities such as blogs and discussion boards, a comprehensive understanding of the landscape surrounding off-road vehicles and ecotourism practices is achieved. By examining current products and gathering insights from experts and enthusiasts, this research aims to uncover challenges, emerging trends, and user preferences, laying the foundation for the development of an impactful solution.

2.2.1 Benchmarking – Benefits and Features of Existing Products

					
	1	2	3	4	5
Product	Conqueror UEV-490	SUV (modified) i.e. Land Cruiser	RV	Ecolodges	Glamorous Camping (Glamping)

Price (CAD)	~$80,000	~$60,000	$200,000	NA	NA
			Benefits		
	- Off-road durability - Independent suspension - Compact living space - Quick setup and pack-up - Durable construction - Versatile add-ons	-Reliable - Adaptability to various terrains - Off-road performance - Availability - Exceptional towing capacity - Customization potential - Safety features - Community (meeting people)	- Comfortable living space - Mobility and flexibility - Adaptability - Family-friendly travel - Amenities - All-weather comfort - Durability	- Env. education - Nature conservation - Relaxation and rejuvenation - Community (meeting people)	- Exclusive locations - Luxurious amenities - Comfort and convenience - Scenic locations - Customized experiences - Unique accommodations - Community (meeting people)
			Features		
Smart	No	Yes	No	No	Yes
Weight	1800-2250 kg	~2600 kg	~4800 kg	NA	NA
Other Features	- Independent suspension system - Water tanks - Hot water sys. - Modular kitchen + fridge	-Enhanced structural rigidity - High ground clearance - Multi-terrain select system - Rear locking differential	- Kitchen - Bathroom - Dining area - Water purification - Storage	- Renewable energy sources - Sustainable practices - Natural landscape integration	- Luxury accommodations - Scenic locations - High end dining experiences - Outdoor activities

	- Air conditioner - Microwave - Galvanized BBQ Grill - Fire extinguisher - 80W foldable solar panel - 120W foldable solar panel	- Front stabilizer bar disconnect - Full-Time 4WD - i-Force MAX hybrid system - 6,000lbs max tow capacity - 2400W inverter - 4x USB-C charging ports - Apple CarPlay - Android Auto - Toyota Safetysense 3.0	- 6.6-liter Turbodiesel engine - 4WD - 800 miles of range - LED lighting - Rear facing camera - Easy to use controls	- Water conservation - Green building materials - Off-grid amenities - Wilderness conservation efforts	- Privacy and seclusion - Modern amenities - Concierge services - Entertainment - Stargazing - Pool/ Spa facilities

Table 2: Benchmarking Ecotourism/ Overlanding Products

Takeaways

Top Benefits of Benchmarked Products

- Off-road capabilities and durability
- Enhanced traction and stability in various terrains
- Convenience and comfort
- Family-friendly travel
- Easy to use controls for user-friendly experience

Top Benefits of Benchmarked Features

- Independent suspension system
- Full-time 4WD
- Storage space
- Versatility and adaptability
- Structural durability/ rigidity

2.2.2 Benchmarking – Functionality of Existing Products

The functionality of a product is the features that allow that product to be used and perform the way that it's intended to. Conducting product benchmarking helped find features that are common and shared amongst most of the ecotourism and overlanding choices. The main features that were analyzed were the overall weight and size of each product.

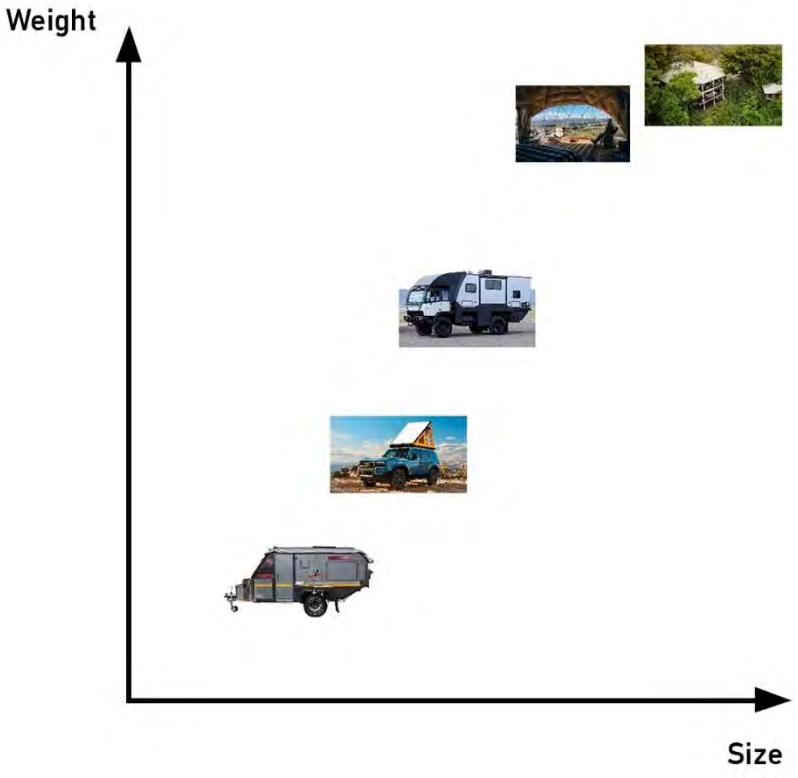

Figure 3: XY Functionality Graph

Takeaways

- Smaller sizes vehicles tend to be lighter in weight (but may not always be the case)

- Heavier vehicles may offer increased stability and towing capacity making them suitable for rugged terrain/ towing heavy loads

- Lighter vehicles may be more agile and maneuverable off-road

- Heavier vehicles may have more space for amenities such as larger living quarters, while lighter vehicles may prioritize compactness and efficiency

- The weight of a vehicle can also impact its environmental footprint

2.2.3 Benchmarking – Aesthetics and Semantic Profile of Existing Products

					
	1	2	3	4	5
Product	Conqueror UEV-490	SUV (modified) i.e. Land Cruiser	RV	Ecolodges	Glamorous Camping (Glamping)
Overall Form					
Shape	Geometric Angular lines and defined edges	Geometric aspects, organic curves in body	Geometric Boxy structure and sharp angles	Organic Inspired by natural forms	Varies from organic tent structures to geometric luxury setups
Balance					

Style	Contemporary and utilitarian	Classic and versatile Ruggedness & sophistication	Modern and utilitarian	Nature-oriented and sustainable	Elegant and lavish
Organic/ Geometric	Primarily geometric	Blend of organic and geometric elements	Predominantly geometric	Primarily organic	Can exhibit a mix of organic and geometric

Table 3: Benchmarking Ecotourism/ Overlanding Products Form

Takeaways

- Majority of products are geometric in shape
- Utilitarian style being a common theme between some products
- Angular lines
- Defined edges

2.2.4 Benchmarking – Materials and Manufacturing of Existing Products

Materials

This section will focus on the materials of the off-road ecotourism vehicle. The use of current materials being used will also be investigated, along with any possible opportunities for green initiatives. Materials for parts of the vehicle including the vehicle's body, flooring, seating, and more will be outlined in this section.

Vehicle Body

In the manufacturing of vehicle bodies, various materials are used to ensure durability, functionality, and aesthetic appeal. Common materials can include aluminum alloys, high-strength steel, or even composite materials such as carbon fiber. High-strength steel provides excellent structural rigidity, while aluminum offers lightweight properties, enhancing fuel efficiency. High-strength steel is highly recyclable, with most steel used in automotive applications containing

recycled content. Vehicles constructed with high-strength steel are durable and long-lasting, extending their operational lifespan and reducing the need for premature replacement.

Coatings

Additionally, waterproof coatings can play a crucial role when dealing with vehicles with amphibious capabilities. These coatings help protect the vehicle's body from water ingress, corrosion, and possible damage caused by exposure to moisture. Advanced waterproof coatings create a protective barrier, ensuring that the vehicle remains watertight even in more challenging environments. Some examples include marine-grade epoxy coatings and Nano-coatings. Marine-grade epoxy is currently being used in the application of protective coatings to ships and their components, which provide durable and corrosion-resistant barriers against the marine environment and the elements. Nano-coating, also referred to as ceramic coating, is the application of a surface layer that repels dry particles, water, dirt, and more. It is an anti-corrosive coating that when applied to a metal, stops chemical compounds from coming into contact with corrosive materials which can stop processes such as oxidation (*What Is Nano Coating? - an Introduction to Ceramic Coatings*, n.d.). By incorporating waterproof coatings into the manufacturing process, amphibious vehicles can maintain their structural integrity and performance, offering reliability and longevity in both land and water operation.

Flooring

When benchmarking flooring options for the interior of a vehicle that would be used for off-road ecotourism, several factors come into play to ensure optimal performance and suitability for the intended use. First, material composition of the flooring must be carefully assessed, considering factors such as durability, water resistance, and ease of cleaning. Options such as vinyl, laminate, linoleum, and engineered hardwood are compared to determine their suitability in a mobile environment. Additionally, the thickness and density of the materials are also evaluated to better

gauge their ability to withstand heavy foot traffic, impacts, as well as temperature and humidity fluctuations. Thicker and denser materials may offer better durability and insulation, which are important considerations for vehicles subjected to various environmental conditions. Waterproofing features and treatments play a significant role in final material choice, particularly for vehicles such as off-road living solutions. Materials with integrated waterproof layers or coatings are desired to protect against water damage. Environmental sustainability is another key consideration, with preference given to materials that are eco-friendly and sustainably sourced.

Interior Materials and Fabrics

With sustainable materials for interior use, it's important to consider various factors such as environmental impact and durability. Among some options available, recycled leather, organic cotton, hemp, Piñatex, and cork fabric. Recycled leather stands out as a sustainable choice, utilizing reclaimed leather and eco-friendly processing methods to minimize waste and reduce environmental harm. Organic cotton is another promising option, cultivated without synthetic pesticides or fertilizers, thereby promoting soil health, and supporting fair labor practices. Hemp fabric offers a unique blend of durability, breathability, and biodegradability, making it an eco-friendly alternative with minimal environmental impact. Piñatex, derived from pineapple leaf fibers, provides a vegan leather option that repurposes agricultural waste and reduces reliance on traditional leather production. Lastly, cork fabric, sourced from the bark of cork oak trees, offers lightweight, water-resistant, and hypoallergenic properties while being a renewable resource that can be harvested sustainably. By carefully benchmarking these sustainable materials, designers can make informed choices to create interior spaces that prioritize environmental responsibility without sacrificing quality or style.

2.2.5 Benchmarking – Sustainability of Existing Products

The benchmarked products within the off-road ecotourism sector exhibit various approaches to sustainability and durability in their design and construction. The Conqueror UEV490, renowned for its rugged off-road capabilities, emphasizes durability by utilizing materials such as steel for the chassis and aluminum for lightweight components. The Toyota Land Cruiser stands out for incorporating high-strength steel, aluminum, and recycled materials in its construction, aligning with sustainability goals. The Predator 6.6 RV focuses on functionality through its fiberglass or aluminum structure, potentially integrating eco-conscious materials in specific components. Ecolodges can prioritize sustainability by employing locally sourced, reclaimed, or recycled materials such as bamboo and reclaimed wood, aiming for an environmentally compatible integration. Glamorous camping sites cater to luxury within natural settings, utilizing eco-friendly tent fabrics, wooden structures, and renewable energy sources, offering an upscale off-road ecotourism experience. These products collectively showcase diverse design philosophies, reflecting a spectrum from durability and functionality to luxury and sustainability, addressing various user preferences and environmental considerations in the realm of off-road ecotourism.

Figure 4: Conqueror UEV-490

The off-road camper company Conqueror started with both designing and supplying tough and durable trailers for the military, but over the years has evolved to creating durable trailers for anyone to enjoy. Most models are manufactured with a combination of aluminum and motor industry grade electro galvanized steel, which are recyclable materials and contribute to reducing environmental impact. The use of epoxy coating and powder coating enhances durability and longevity, preventing frequent replacements and minimizing waste. Conqueror also tries to avoid the use of wood, fiberglass, or other degradable materials reduces environmental degradation and promotes sustainability (UEV 490 Platinum Edition, n.d.).

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Figure 5: Predator 6.6 RV

The Predator 6.6 RV, made by Hunter RMV, is a rugged recreational vehicle that was designed for off-road adventures and exploration. Crafted with a blend of lightweight aluminum, reinforced steel, and more, the Predator 6.6 offers strength and versatility while still incorporating the use of some sustainable materials.

2.3 Summary of Chapter 2 – Topic Understanding

In summary, the primary user research that was gathered brought many insights into the primary target user group by gaining a better understanding of adventurers and enthusiasts' day to day lives, and what exactly makes them want to get outside and go on an ecotourism or overlanding adventures.

CHAPTER 3: ANALYSIS

The following chapter will dive into the user needs using various maps and diagrams to rearrange and reassess the research gathered. Additionally, a human factors ergonomic study will also be conducted to gather additional information.

3.1 Analysis – Needs

This section outlines the needs and benefits that are not met by current products, their latent needs, as well as a categorization of needs.

In the realm of off-road ecotourism, a comprehensive analysis of user needs and environmental demands becomes important in shaping effective design decisions. Understanding the subject matter involves delving into the requirements of individuals engaged in ecotourism, including their preferences for mobility, comfort, and safety during off-road expeditions. Additionally, insights gathered from benchmarked products reveal diverse approaches to sustainability, durability, and luxury. These findings serve as essential benchmarks for critical thinking, guiding the design process toward a solution that balances durability, functionality, luxury, and sustainability.

3.1.1 Needs/ Benefits Not Met by Current Products

Creating a STEEPV matric can help identify unmet needs and areas for improvement in the context of off-road ecotourism and overlanding products, aiming to fill the gaps to seize opportunities for enhancement. This matrix assesses the Social, Technological, Environmental,

Economic, Political, and Values related aspects of current products being used. The identified opportunities and challenges can guide the design process to meet unmet needs and innovate for improvement.

Table 4: STEEPV Analysis

Area	Opportunity	Challenge
Social	Enhancing social interaction within off-road vehicles; creating spaces that facilitate social connections during trips.	Ensuring inclusivity and accessibility for diverse user demographics in terms of ease of use and comfort.
Technological	Integrating advanced communication systems for safety and emergencies, leveraging emerging technologies for connectivity and real-time monitoring.	Balancing technological sophistication with user-friendly interfaces, creating ease of operation for users without compromising on functionality.
Economic	Designing cost-effective solutions that offer luxury and sustainability, optimizing materials and processes to reduce production costs without sacrificing quality.	Balancing the cost-effectiveness of the vehicle with high-quality materials and sustainable technologies, avoiding excessive pricing barriers.
Environmental	Furthering sustainability efforts by using eco-friendly materials, implementing renewable sources for vehicle operation such as hybrid powertrains for vehicle operation, and reducing the environmental footprint through efficient decisions.	Maintaining ruggedness and durability while integrating sustainable materials; ensuring the vehicle's capabilities are not compromised in environmentally friendly design modifications.
Political	Advocating for policies supporting eco-friendly initiatives in vehicle manufacturing, promoting incentives for sustainable	Navigating regulatory frameworks that might restrict certain design innovations or materials, ensuring

	design practices in the automotive industry.	compliance with safety and environmental standards.
Values	Aligning design with user values (i.e. adventure, sustainability, connection with nature, etc.) emphasizing experiential and ethical aspects in the vehicle's functionalities.	Addressing conflicting user values or preferences, ensuring design caters to a broad range of user values without compromising the core purpose or functionality.

3.1.2 Latent Needs

Table 5: Human Needs

Fundamental Human Needs	Benefit Statement	Importance
Psychological Needs (food, water, shelter, comfort)	- Provides essential sustenance, ensuring physical health and vitality - Offers comfort, promoting mental well-being/ rejuvenation	High
Safety Needs (security, safety)	- Promotes a sense of security when in use, reducing stress and anxiety - Ensures personal safety and protection from any potential harm or danger	High
Social Belonging (friends, relationships)	-Facilitates and fosters emotional well-being - Creates a sense of community, reducing feelings of isolation	High
Esteem (feeling accomplished, prestige)	-Enhances self-confidence and self-worth resulting in promoting a positive self-image	Moderate
Self-actualization (reaching full potential, creative endeavors)	-Encourages personal growth and achievement, leading to personal gratification through exploration, discovery, and pushing personal boundaries in unfamiliar environments.	High

	- Enhanced enjoyment of nature - Personal fulfillment and satisfaction - Emotional connection with nature	

- Featuring analysis of fundamental needs and relationship with benefits

- Understand the latent needs of the user, discuss how the product responds to the user on a fundamental level, and identify needs that will be met by your proposed (final) product.

- Can be based on Maslow's 5 Levels Hierarchy of Needs, Roots of Cause (an initiating cause of either a condition or your problem definition that leads to an outcome or effect of interest), Prioritization Grid of User Needs (visual charts, diagrams or matrices to help decision making base on objective and relevant criteria), or extract from STEEPV study.

3.1.3 Categorization of Needs

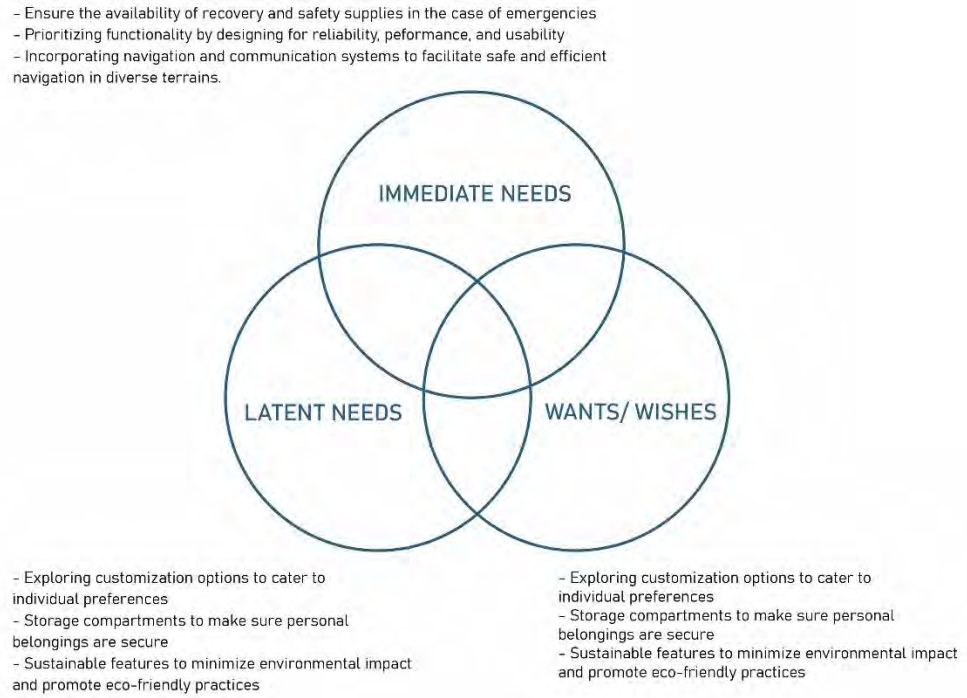


Figure 6: Categorization of Needs

3.2 Analysis – Usability

Design maps are extremely helpful in the design process, arranging primary research data gathered to comprehend user motivations, needs, and experiences effectively. They ensure that future design concepts address key user pain points and provide suitable solutions. Framing the user perspective involves several maps: an empathy map, aiding in grasping the user persona; a journey map, outlining the user's daily routine; and an experience map, highlighting challenges in their routine and potential design ideas. Additionally, a STEEPV map offers a broader understanding of the social context related to the design. These maps collectively aid in tailoring designs that directly address user needs and enhance the off-road ecotourism experience for seniors in Nova Scotia.

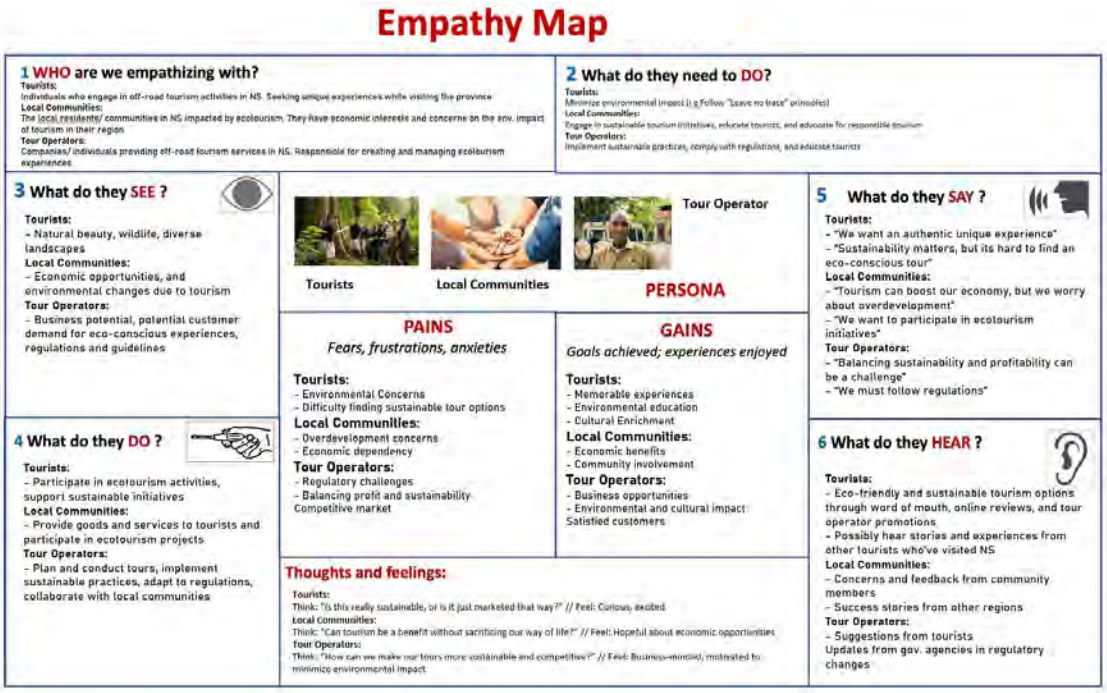


Figure 7: Empathy Map

3.2.1 Journey Mapping

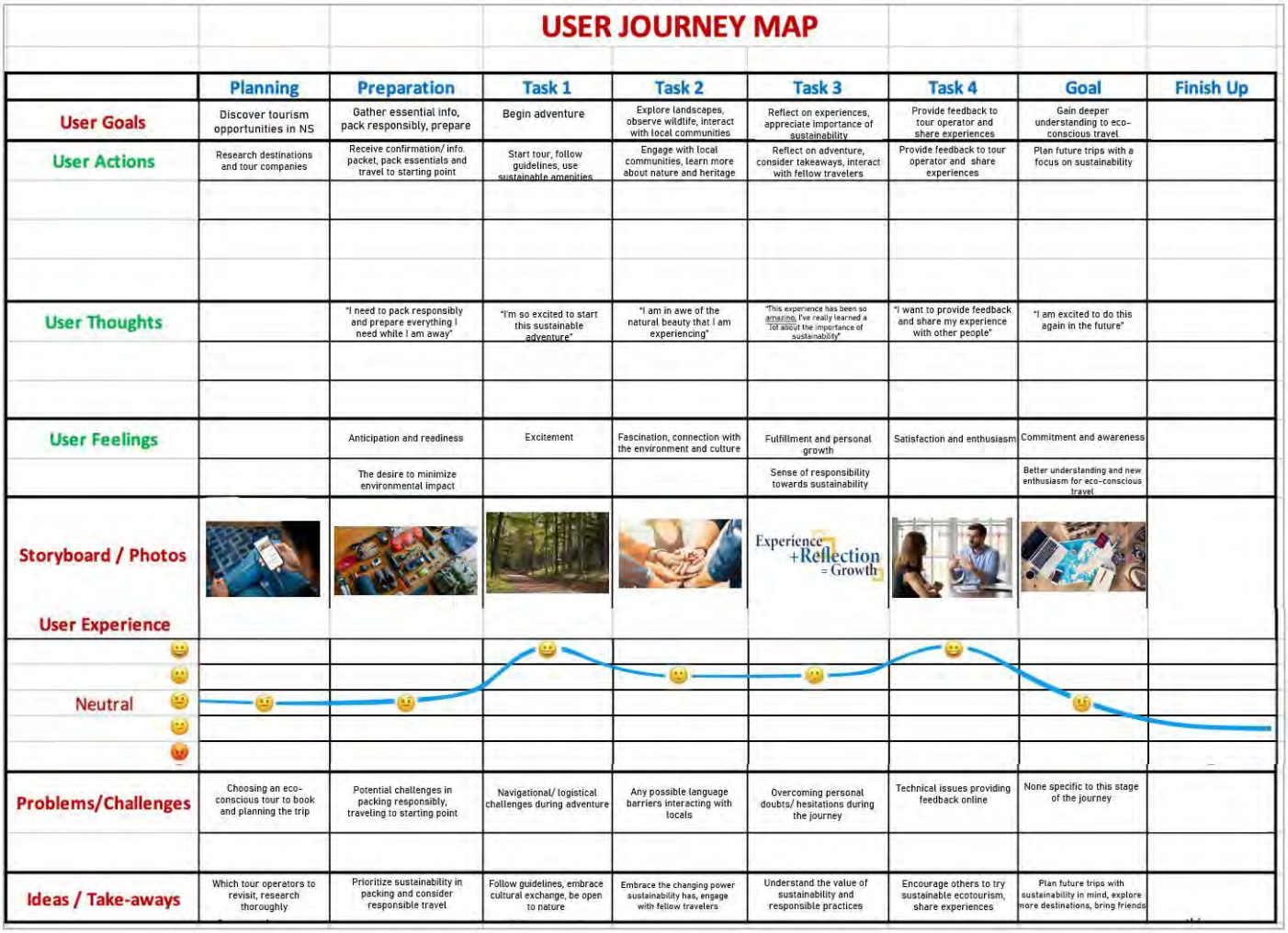


Figure 8: Journey Map

3.2.2 User Experience

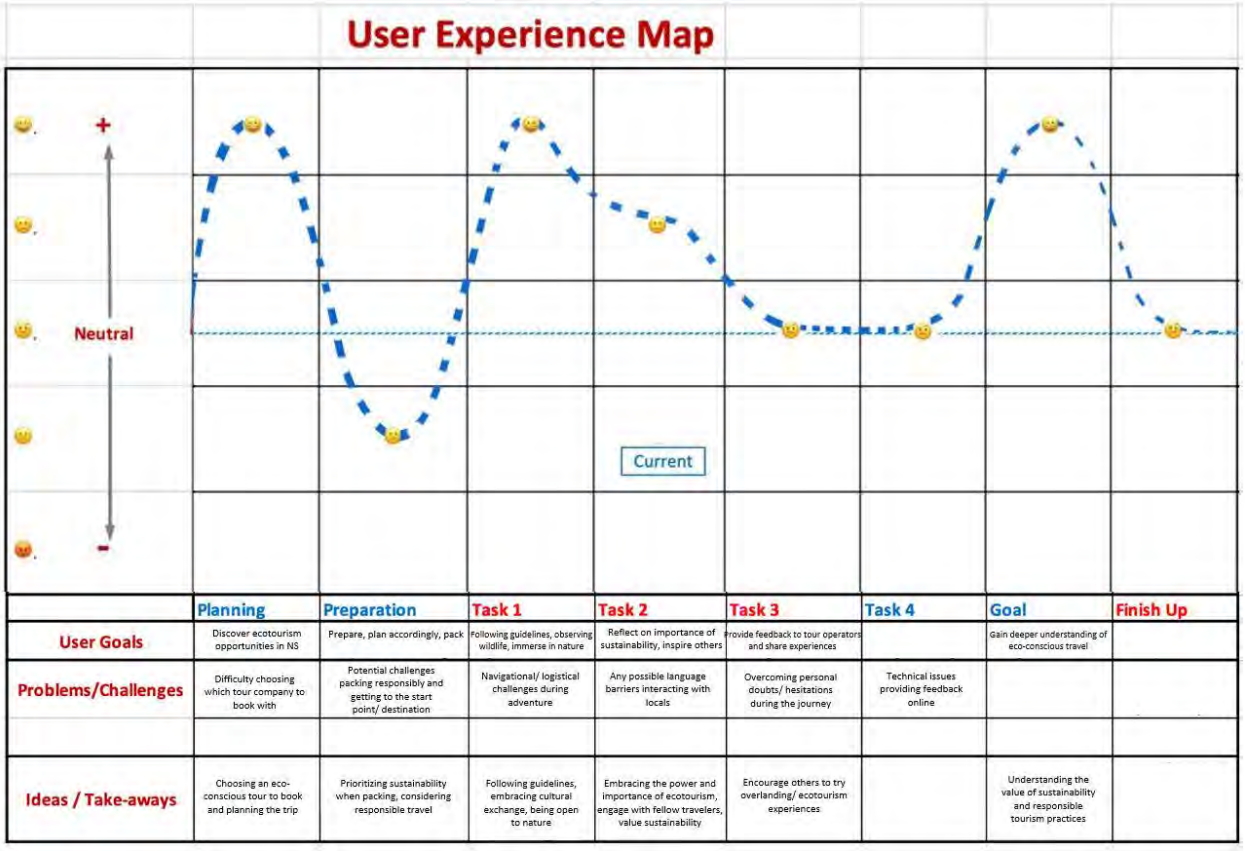


Figure 9: User Experience Map

3.3 Analysis – Human Factors

The following section will present an outline of the human factors as well as the initial ergonomic study completed for this project. This study consists of schematic diagrams (3.3.1) and a 1:1 scale mock-up (3.3.2). The ergonomic study will focus on some of the main touch points of the vehicle, such as:

1. The front cab (dashboard)
2. Fold-out bed in both sitting and sleeping positions
3. Kitchen unit using both a sink and stovetop

The anthropometric data utilized in this ergonomic study was sourced from The Measure of Man and Woman (2002), specifically focusing on the 99th percentile male as reference, relevant to the demographic targeted in the study of off-road ecotourism. As individuals age, they typically experience a decrease in height due to cartilage compression, primarily in the spine. Elderly men may lose up to 5% of their height by the age of 65, while elderly women may lose nearly 6%. This data was employed to determine overall body dimensions relevant to the design of ROAM. Additionally, data for the 99th percentile male and 5th percentile male were utilized for the design ergonomics of various components within the vehicle.

The purpose of this study is to recognize the significance of sustainable off-road vehicles and the fact that they serve as a viable opportunity for tourism and overlanding while minimizing environmental harm. By focusing on eco-friendly designs, this venture aims to offer tourists and visitors sustainable means to explore natural landscapes while promoting sustainable practices.

Three primary touchpoints will be evaluated and observed in this ergonomic study, to create an easy and comfortable experience when interacting with ROAM:

1. Interaction with the front cabin; operating the vehicle, navigating the screen located in the center (arms, hands)
2. Using the fold-out bed (legs, feet)
3. Using the kitchen unit; sink and cooktop (hands, arms)

The target user for this study is aimed at both tourists and visitors exploring the off-road ecotourism opportunities in Nova Scotia. Tourists and visitors cover a wide range of age groups and can vary, typically spanning from 26 to 60 years old and including both males and females. Their

educational backgrounds vary, and they come from diverse geographic locations, primarily consisting of tourists visiting Nova Scotia for ecotourism adventures and to explore natural landscapes.

The evaluation process utilized a full-scale ergonomic mock-up of the interior of ROAM to be used for user observation of the following:

1. Analyzing user interaction, addressing ergonomic concerns and usability factors related to various percentiles
2. Interior cab positioning and layout
3. Accessibility and layout within living quarters of the vehicle

The results of the ergonomic study are depicted below. Ergonomic schematics display the percentiles using ROAM and its touch points. The physical 1:1 ergonomic model illustrates the touch points with human model reference of a 90th percentile male and 5th percentile male.

Literature Review

The exploration of ergonomics and human factors within the realm of off-road overlanding and ecotourism vehicles unveils many insights from various scholarly sources, prominently including Henry Dreyfuss's seminal work. Dreyfuss is renowned for his significant contributions to the field of industrial design and ergonomics, particularly in understanding human-centered design principles. His work focused extensively on the importance of designing products that align with users' physical and cognitive capabilities, emphasizing user comfort, efficiency, and safety. In his book *"The Measure of Man and Woman: Human Factors in Design,"* Dreyfuss meticulously outlined ergonomic considerations, offering valuable insights into anthropometric measurements and their application in product design. This aligns with the challenges and complexities of designing user-centric and functional interiors within off-road vehicles for ecotourism and overlanding purposes.

Additionally, references such as Wilson and Corlett (2005) and other scholarly works have expanded upon Dreyfuss's principles, emphasizing the crucial role of ergonomic design in creating user-friendly interfaces and optimizing usability within vehicle cabins. The integration of Dreyfuss's principles and these additional references is essential to enhancing user experiences and operational efficiency in
the context of off-road vehicle design.

Methodology

The ergonomic evaluation and analysis of current off-road ecotourism and overlanding vehicle designs was conducted with the following:

Objectives

The objective of this assessment was to establish the optimal dimensions for the design with interaction design and ergonomic considerations for the various user-centered sections of the vehicle relevant to off-road ecotourism, focusing primarily on areas such as the living quarters and the driver's cabin. This analysis prioritizes three key factors relevant to the theme of human factors. This evaluation centered on scrutinizing these specific aspects, outlining various methodologies employed to fulfill three primary objectives aimed at enhancing user comfort and operational efficiency within the vehicle, aligning with the ethos of human factors. The ultimate aim was to ensure an environment conducive to easier navigation and functionality for users engaging in off-road ecotourism activities.

Decision(s) to be made

In the context of our thesis project on off-road ecotourism vehicles, the investigation focused on optimizing user experiences by scrutinizing interactions related to specific body part areas

relevant to ergonomic design considerations. The following interactions were analyzed to diminish negative experiences and enhance positive experiences:

1. Entering and exiting the vehicle efficiently and comfortably
2. Assessing operating visibility to ensure optimal visibility for the user, enhancing safety and maneuverability.
3. Evaluating the interaction with operating controls along with touch points within the living quarters, emphasizing ergonomic considerations for hand and arm movements, and aiming for intuitive and user-friendly controls within the vehicle's design.

Description of Users Targeted by Product

The target user for this study is aimed at both tourists and visitors exploring the off-road ecotourism opportunities in Nova Scotia. Tourists and visitors cover a wide range of age groups and can vary, typically spanning from 26 to 60 years old and including both males and females. Their educational backgrounds vary, and they come from diverse geographic locations, primarily consisting of tourists visiting Nova Scotia for ecotourism adventures and to explore natural landscapes.

Evaluation Process

The evaluation process for this study involved an in-depth examination of the off-road ecotourism vehicle design. Using a 1:1 scale ergonomic buck that was created, the following sections were observed:

1. Analyzing user ingress and egress and how users enter and exit the vehicle, addressing ergonomic concerns and usability factors related to various percentiles
2. Interior cab positioning and layout
3. Accessibility and layout within living quarters of the vehicle

Description of User Observation Environment Used in This Study

In this study, the cabin space as well as the living quarters of the vehicle were observed. This was done to gain a better understanding of the vehicle's overall dimensions and to understand the interior space and layout clearly.

Location and Timeframe

Observation Date(s):	November 29th, 30th, 2023
Observation Location(s):	Humber College North Campus

3.3.1 Product Schematic – Configuration Diagram

The ergonomic figures depicted in figure _ show the two percentiles being utilized as part of this schematic. The measurement of these percentiles was referenced from The Measure of Man and Woman (2002) to better determine the overall sizing of the ergonomic model. The 99th percentile male measures at ___ tall, and the 5th percentile female is ___.

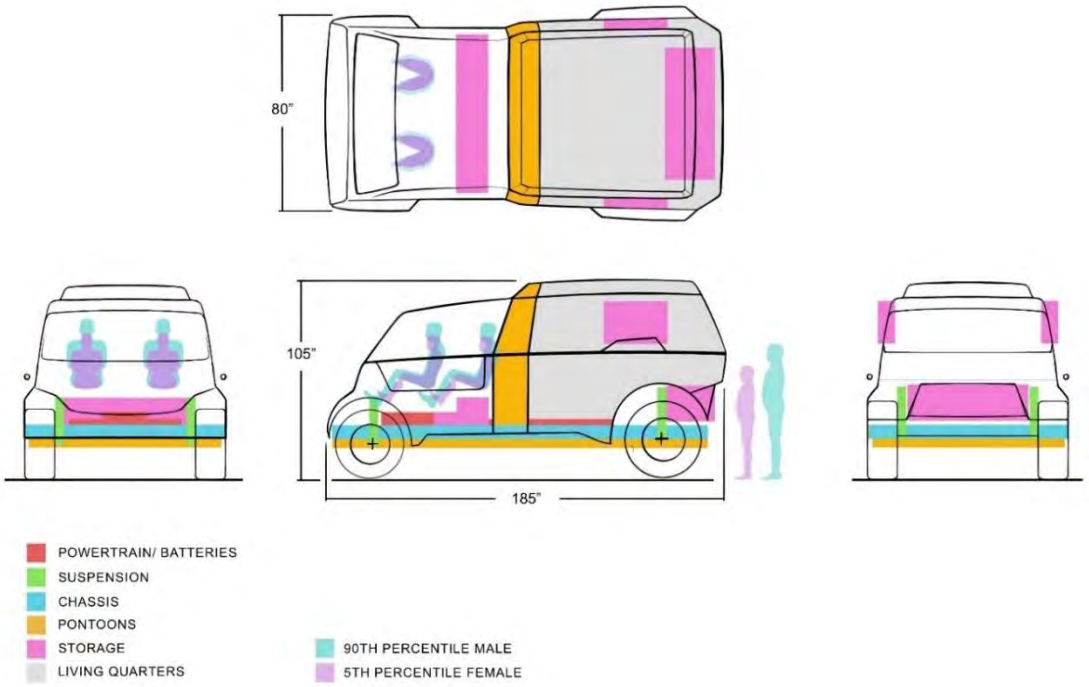


Figure 10: Schematic 1: Orthographic Views - Exterior

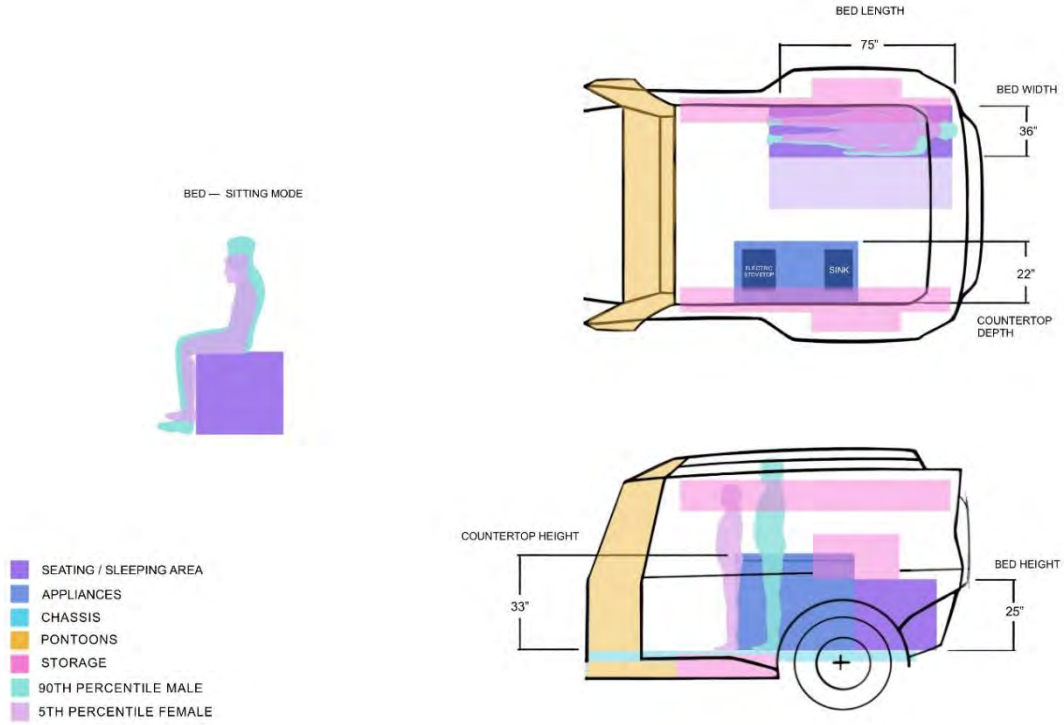


Figure 11: Schematic 2: Living Quarters

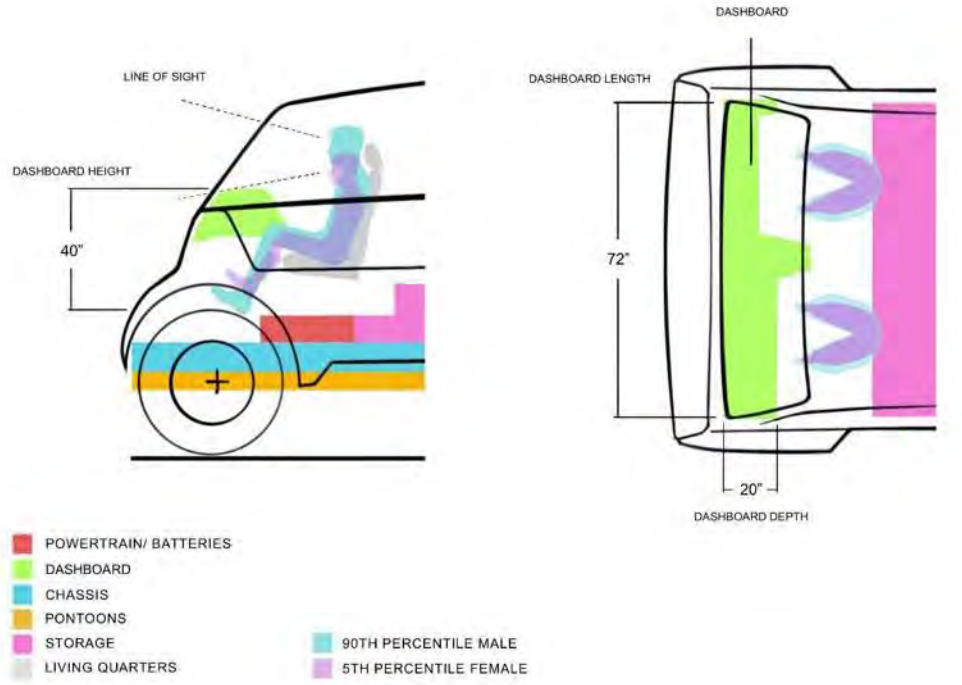
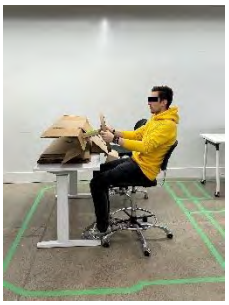
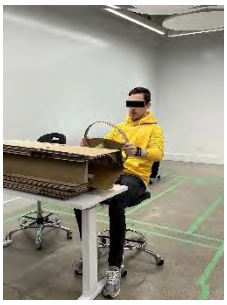
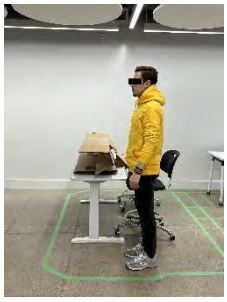
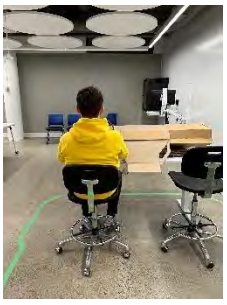
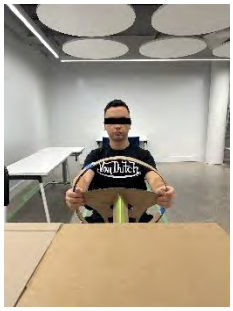
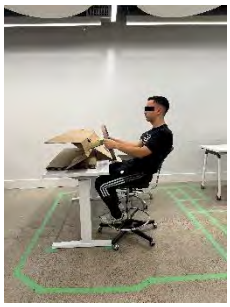
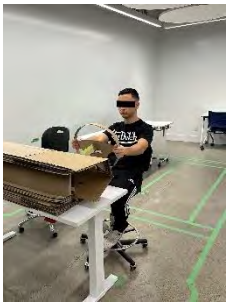


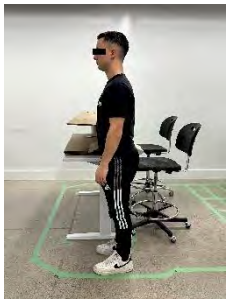
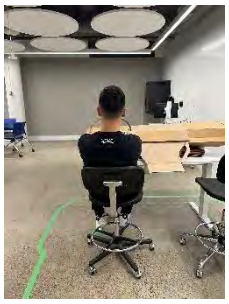
Figure 12: Schematic 3: Front Cab

3.3.2 Ergonomic – 1:1 Human Scale Study

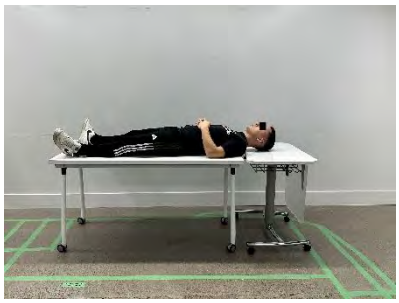
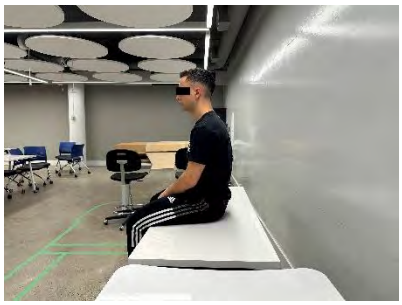
The following section will present results from the 1:1 scale physical ergonomic study conducted using the 99th percentile male and 5th percentile male. This section will also include analysis, limitations, and concluding remarks gathered from the 1:1 scale ergonomic study. The studies on product schematic and configuration diagrams are important in the developmental phase, assisting in influencing the ergonomic study. They serve as foundational elements informing design decision-making by providing insights into the layout, component arrangements, and overall structure of the vehicle. These studies directly influence ergonomic considerations, ensuring that the design aligns with the physical requirements and comfort of users engaged in off-road ecotourism.

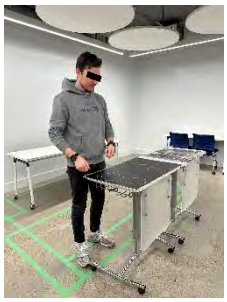
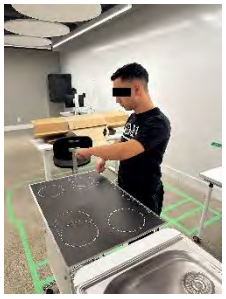
Table 6: Ergonomic Study

Sitting and Standing - Front Cab
The first ergonomic test was sitting, standing, and operating the screen in the dashboard of the front cab. The seat where the user will operate the vehicle from features an adjustable seat, allowing users of various heights to be able to sit with ease. The 90th percentile male had no issues with the height of the steering wheel, center console, or seat height. The 5th percentile male was able to get seated without difficulty, although they had to slightly stretch their arm to access some controls.
90th Percentile Male
  
  
5th Percentile Male
  


Living Quarters – Fold-out bed
In the living quarters of the vehicle, users have a bed that not only acts as a bench or bed that sleeps one but can be folded out to fit two people when sleeping. The height of the bed from the floor of the vehicle is 25” inches, which is considered as ideal or normal. This seemed to be a comfortable height for both percentiles with no issues. This study focuses on the legs/ feet and how the user interacts with the bed, whether it is being used to lie down on or sit on like a bench.
90th Percentile Male
 
5th Percentile Male

Living Quarters – Using Appliances
This study focuses on the use of the integrated kitchen unit within the living quarters of the vehicle, specifically using the sink and stovetop. The surface of the countertop is 33” inches, proving itself comfortable for both percentiles tested during this study.
90th Percentile Male
 
5th Percentile Male
 

3.3.2.1 Analysis

In the ergonomic study conducted, an in-depth analysis was undertaken to evaluate user interactions, functional efficiency, and overall usability within the interior space of the vehicle. The study aimed to optimize the design to meet the diverse needs of users engaging in off-road ecotourism activities. The movements that the user would most commonly execute within the interior are sitting, standing, pulling out the fold-out bed, or using their hands when using the kitchen unit. Utilizing an adjustable seat for the user operating the vehicle helped result in a successful study, allowing for users of various heights to be open to mount and dismount from the seat with ease. Using ideal heights that are considered common for the fold-out bed as well as kitchen unit countertop also played a factor in a successful study.

The front cab dimensions were almost completed successful, with the only slight issue being smaller percentiles may find some difficulty reaching for the screen in the center console, but this was resolved with additional testing by modifying the dashboard to feature a screen, angled towards and located closer to the operator, allowing for easier reachability.

3.4 Analysis – Aesthetics & Semantic Profile

In the world of off-road vehicles designed for ecotourism, established aesthetic and semantic profiles have typically leaned towards robustness, toughness, and a rugged appearance. Traditional off-road vehicles often feature darker or more natural tones and intimidating designs, reflecting a serious, functional approach targeted at adventurous individuals. Any features or components that are important can sometimes be featured in a bright, vibrant colour (i.e. emergency supplies). These vehicles commonly give off a mechanical and industrial feel, focusing more on functionality than on intricate stylization. The intent of this project is to create a design that offers an inviting atmosphere,

allowing users to feel comfortable and free from judgment about their off-road exploration abilities or preferences. The focus remains on creating an aesthetic and semantic profile that encourages approachability and a sense of belonging for users engaging in off-road ecotourism in Nova Scotia, diverging from the typical conventions seen in traditional off-road vehicle designs.

3.5 Analysis – Sustainability: Safety, Health, and Environment

With the use of an off-road camping vehicle, in the sustainability analysis, safety, health, and environmental stewardship would be priorities. Nova Scotia's weather and various terrains change drastically depending on the season, and a vehicle being used to travel off-road should be capable and should be able to make users feel comfortable where personal safety would be a concern. Safety features include reinforced structures and advanced braking systems to ensure passenger protection during rugged terrain exploration. Health considerations surround ergonomic design as well as low VOC (Volatile Organic Compounds) emissions to promote comfort and well-being. Environmentally, opting for materials that are lightweight, recyclable, and cradle-to-cradle manufacturing to help minimize resource consumption and waste. Exploring innovative business models that align economic incentives with environmental goals is also important, such as incentivized recycling programs to prolong product lifespan, reduce resource consumption, and promote a circular economy, aiding in fostering a holistic approach to sustainability.

The emphasis on safety, health, and environmental stewardship in the sustainability analysis could impact the design and development of ROAM. Safety considerations, such as reinforced structures and advanced braking systems, would directly influence design decisions to prioritize passenger protection during rugged terrain exploration. Health considerations, including ergonomic design and low VOC emissions, would guide design decisions aimed at promoting user comfort and well-being. Environmental considerations would lead to the selection of durable, lightweight,

recyclable materials and cradle-to-cradle manufacturing processes to minimize resource consumption and waste. Exploring innovative business models, such as incentivized recycling programs, would influence design decisions towards creating products that support circular economy principles. These factors could ensure ROAM's alignment with sustainable principles while prioritizing user well-being and environmental responsibility.

3.6 Analysis – Innovation Opportunity

This section will dive into the heart of the thesis problem definition, drawing insights from data that has been collected. This section will include identified key areas where an impact can be made within the world of off-road ecotourism. Through a comprehensive needs analysis diagram along with a desirability, feasibility, and viability chart, potential opportunities for innovation in off-road ecotourism are identified and evaluated.

3.6.1 Needs Analysis Diagram

Problem	Inadequate user experience and comfort in current off-road ecotourism vehicles
Why?	Many existing off-road ecotourism vehicles lack ergonomic design considerations, resulting in discomfort and fatigue for passengers during extended journeys over rough terrain
Why?	The cramped interior layout of current off-road vehicles may restrict movement and storage options, leading to inconvenience and dissatisfaction among users, particularly during longer ecotourism trips
Why?	Inadequate heating, ventilation, and air conditioning (HVAC) systems in off-road vehicles can result in discomfort for passengers,

	especially in extreme weather conditions, detracting from the overall ecotourism experience
Why?	Excessive noise and vibration levels inside off-road vehicles can cause discomfort and fatigue for passengers, impacting their enjoyment of the natural surroundings and contributing to a suboptimal ecotourism experience

Table 7: Needs Analysis Diagram

3.6.2 Desirability, Feasibility & Viability

Desirability	ROAM exhibits high desirability owing to its unique and attractive design, appealing to ecotourists and adventurers seeking distinctive off-road experiences. Functionality is another strength of ROAM, offering a comprehensive range of features tailored to the needs of off-road travelers, enhancing its overall appeal. Sustainability is also a key focus, aligning well with the increasing demand for eco-friendly travel options and further enhancing its desirability. While there exists a moderate demand for off-road camping vehicles, the distinct features and sustainability of ROAM make it particularly desirable in the market.
Viability	In terms of feasibility, ROAM's design is generally feasible, although minor adjustments may be necessary to ensure manufacturability and regulatory compliance. The functionality of ROAM is highly feasible, as proven technologies and components are readily available for integration. Achieving sustainability goals is also feasible, with the use of eco-friendly materials and energy-efficient systems readily achievable. However, the cost aspect may require moderate adjustments to strike a

	balance between affordability, sustainability, and functionality.
Feasibility	With viability, manufacturing ROAM is viable, although it may necessitate moderate investments in production facilities and processes to ensure efficient assembly. The technology required for ROAM is readily available, contributing to its overall viability. Regulatory compliance is crucial for viability, and while meeting these requirements is essential, it may require moderate adjustments to ensure adherence without compromising the design and functionality of ROAM.

Table 8: Desirability, Feasibility & Viability Diagram

3.7 Summary of Chapter 3 – Defining the Design Brief

The design mapping process served as a channel to merge and combine the user's requirements, concerns, and creative concepts gathered from research sources. It was helpful in presenting the data in a structured manner, enabling the creation of a complete framework that outlines the user profile and proposes potential design solutions to enhance their overall experience. The identified needs and desires critical to the design solution are as follows:

1. Off-Road Capabilities: Many individuals with experience overlanding or off-road terrain mentioned that a vehicle with off-road capabilities is important and can change your off-road experience drastically depending how capable your vehicle is on rugged terrain. Features such as 4WD, locking differentials, adaptive suspension, off-road tires, and more are some features that can really increase and enhance your off-road experience.

2. Intuitive User Interface: Developing an easy-to-use interface for controls and navigation, creating simplicity and convenience for all users, whether they are an expert or a novice adventurer.
3. Sustainability Integration: Emphasizes the integration of eco-friendly materials, renewable energy sources, and environmentally conscious technologies. This could involve the use of sustainable materials in the vehicle's construction or exterior/ interior components, aiming to minimize its environmental impact.
4. Accessibility Enhancement: Focusing on ensuring easy accessibility and use for seniors, this guideline involves designing features that accommodate reduced mobility.
5. Safety: In the context of off-road ecotourism, safety considerations play a critical role in ensuring a secure and confident experience for travelers. There are always concerns about accidents or something going wrong when in remote areas and not being near anyone to get help. Incorporating safety features within the vehicle design, such as stable seating arrangements or handholds strategically placed for support during off-road maneuvers, becomes important. These safety provisions not only mitigate the perceived risk of falls or injury, but also bolster confidence among users, allowing them to navigate and engage in various activities within the vehicle without apprehension, ultimately fostering a sense of independence during ecotourism experiences.
6. Comfort: Comfort is an important pillar in the design of an off-road camping vehicle. Throughout Chapter 3, the focus emphasizes the importance of ensuring occupants' comfort within a camping vehicle. By considering ergonomics and user experience, the goal was to create an environment that prioritizes physical well-being and the ability to relax. From the interior layout to the living quarters configuration, every aspect of this vehicle aims to provide a comfortable space for users.

7. Adjustable: Connecting back to comfort, the design should be adjustable to better fit various body sizes to cater to diverse user requirements. Offering adaptable configurations for various spatial elements and features ensures flexibility to meet different user requirements. Additionally, providing adjustable settings for different levels of confidence and preferences in using the vehicle allows for a more inclusive and personalized experience, enhancing user satisfaction and engagement during off-road expeditions.
8. Approachable: The design should be approachable in its aesthetic and should stand out from similar products. Recognizing the diverse range of individuals who may engage with off-road ecotourism vehicles, the vehicle should be inviting and welcome users of all backgrounds and experience levels.
9. Storage Optimization: Creating ample and strategically placed storage compartments within the vehicle to organize equipment, luggage, and supplies efficiently during off-road excursions, ensuring easy access and space optimization.
10. Low-Impact Footprint: Utilizing eco-friendly materials in the vehicle's construction and promoting sustainable practices throughout the production process to reduce environmental impact and promote responsible manufacturing.

CHAPTER 4: DESIGN DEVELOPMENT

4.1 Initial Idea Generation

4.1.1 Aesthetics Approach & Semantic Profile

The aesthetic approach undertaken aligns closely with the comprehensive goals set in the design brief (see section 3.7). Embodying comfort, safety, and having a unique and approachable aesthetic, the chosen visual elements include more of a geometric form with angular lines and edges, fitting with a more rugged look. The design opts for an overall geometric form and mostly sharper edges rather than an organic form, prioritizing a feeling of security and safety and creating a more modern aesthetic. Natural and darker tones are used to signal creativity and enjoyment to potential users. Simplicity and ease of use are central to the design, ensuring intuitive interaction, especially crucial for users seeking straightforward interfaces.

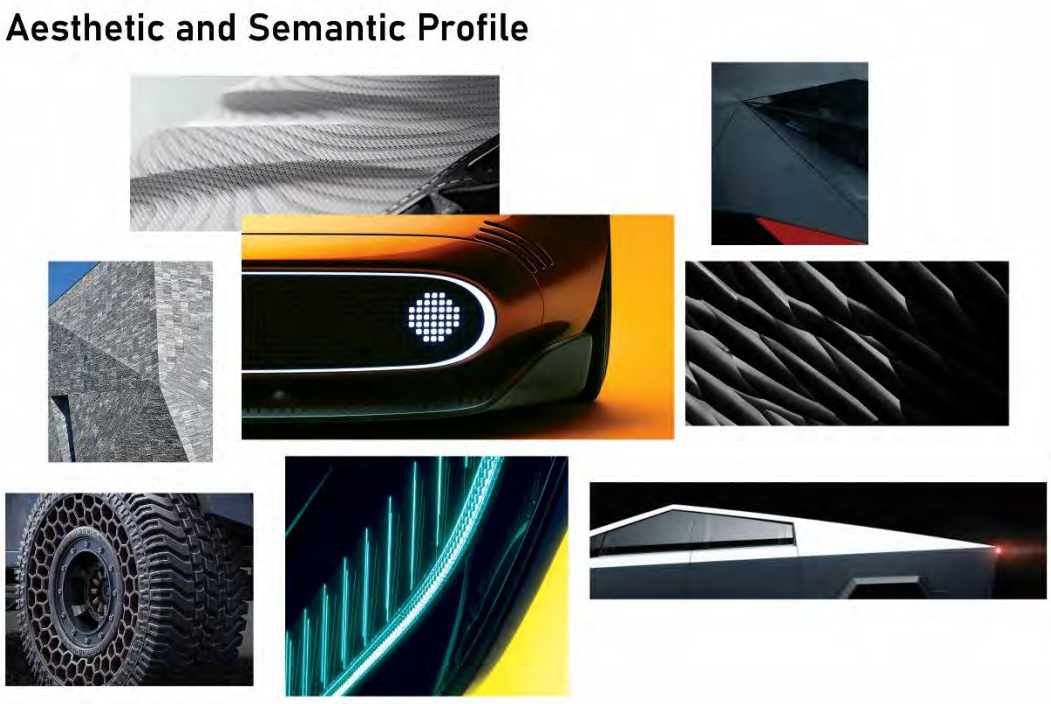


Figure 13: Aesthetic and Semantic Profile

4.1.2 Mind Mapping

Towards the conclusion of the research phase and the initiation of the idea generation phase, mind mapping served as a useful tool in exploring diverse potential solutions to the design challenge. The initial mind map aimed to summarize and combine the various pain points and needs identified, serving as a springboard for establishing connections and formulating preliminary solutions. Afterwards, a refined iteration of the initial mind map focused more keenly on specific needs, ultimately contributing to the development of the design brief (see section 3.7). This approach facilitated the presentation of distinctive potential solutions, detailed in section 4.1.3 Ideation Sketches.

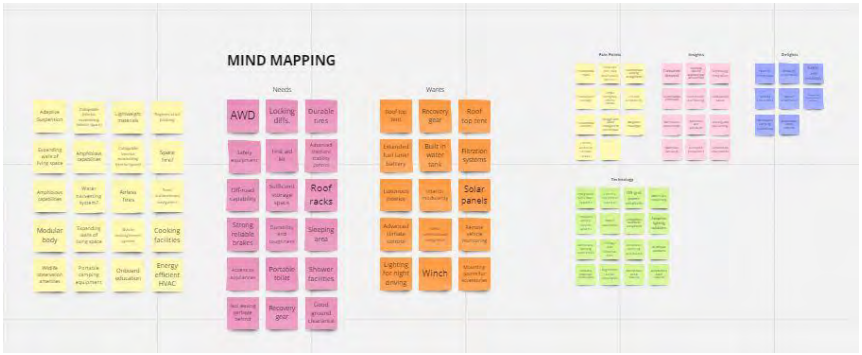


Figure 14: Mind Mapping

4.1.3 Ideation Sketches

The following shown in this section are sketches from the ideation phase that were done prior to the mind mapping that was completed for this project. At this point in the process, the goal was to sketch and develop multiple unique design directions to decide on the best direction possible later. Six ideations were created, each serving as a solution to the problem definition at hand. The six ideations include: an off-road overlanding vehicle, an amphibious off-road camper, a towable living space, a tree camping buggy, and a modular off-road camping truck. The focus during this stage of development was on the design functionality and its ability to cater to the user needs outlined in the Design Brief (see section 3.7).

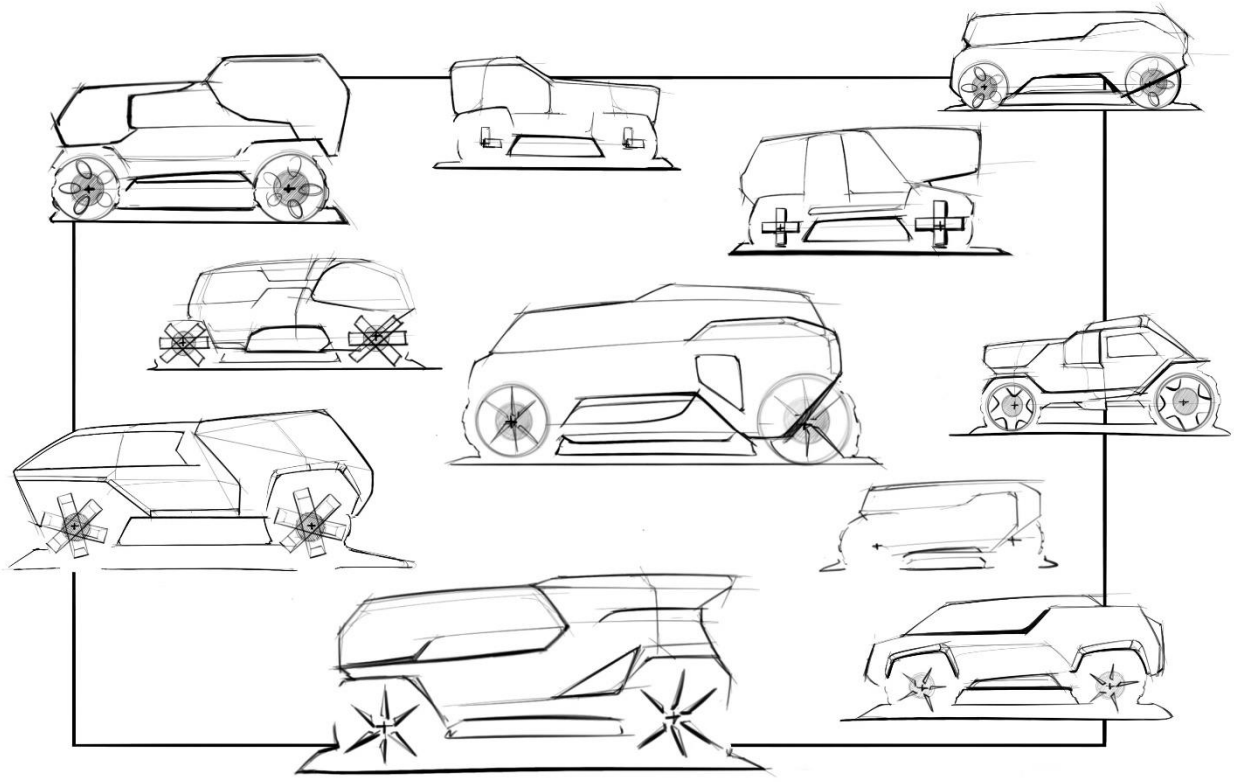


Figure 15 A: Ideation Sketches

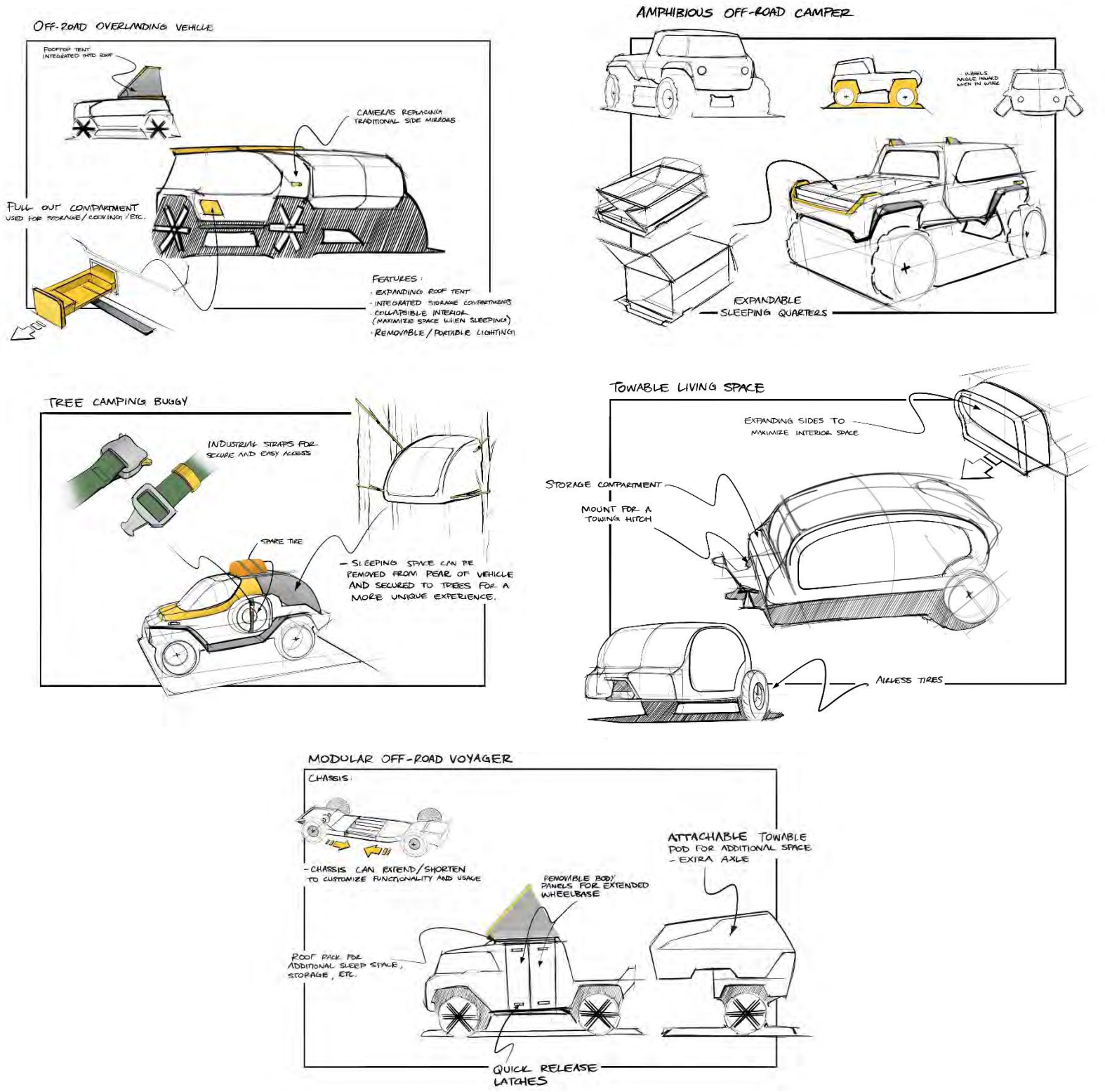


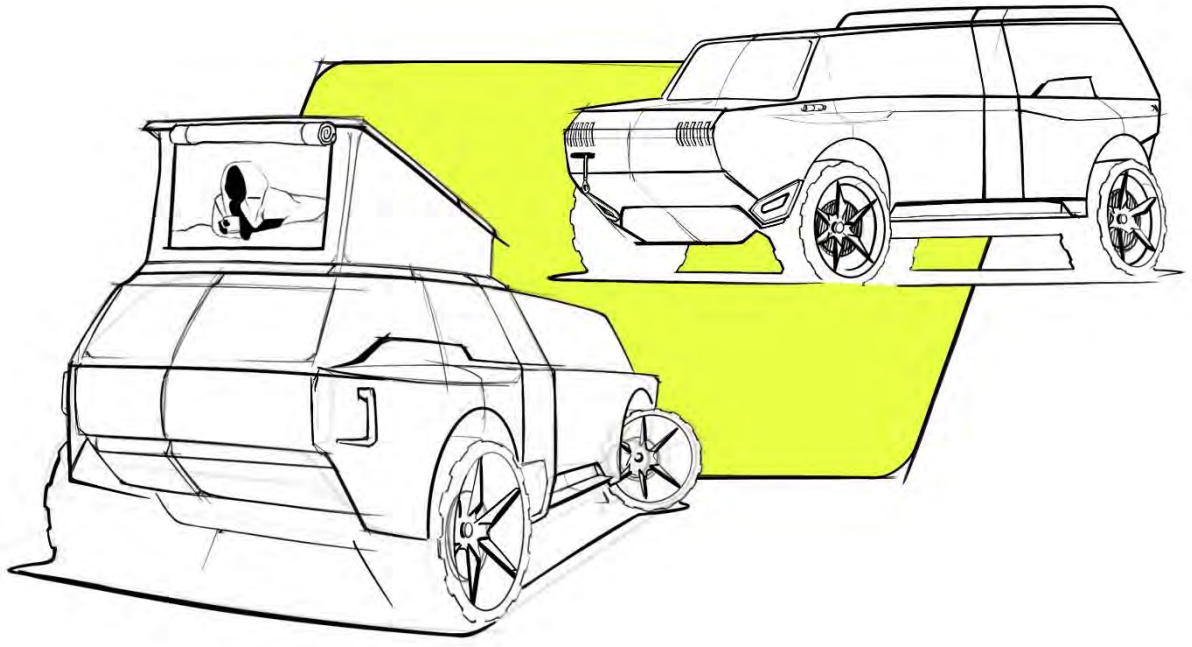
Figure 15 B: Ideation Sketches

4.2 Concepts Exploration

After the ideation phase, two ideations were selected to take forward to develop, which would help with which one of the two would be the final design direction for this project. The concepts that were selected were the open concept off-road camping vehicle and the off-road tree camper. These two concepts were selected because of their unique form, and their potential to become something unique.

4.2.1 Concept One

This first concept was one of the two that were selected, being this open concept off-road camper. It featured a very large geometric body, with a roof tent, opening tailgate, retractable ladder, and a rear section that slid back to create a completely open concept atmosphere from the interior. The front end also featured an integrated winch, and a section of the headlight that was removable to allow the user to use it as a headlight.



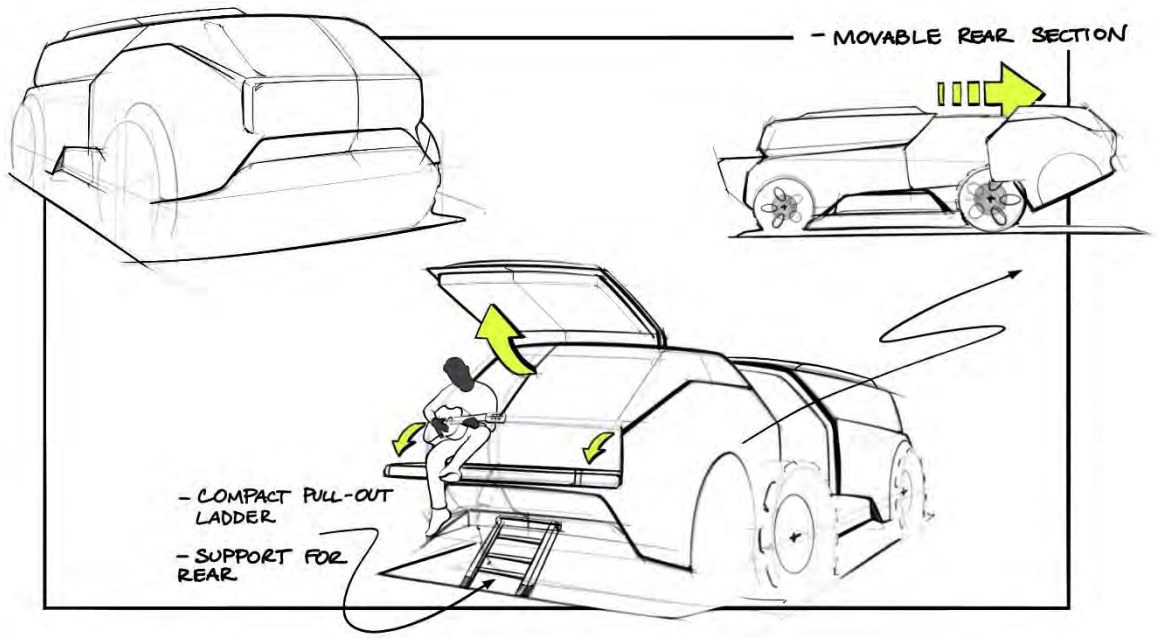


Figure 16: Concept One – Open Concept Off-Road Camper

4.2.2 Concept Two

The second concept is a newer take on the tree camping buggy from the ideation phase. The form is continuing to stay geometric and relatively angular, with the rear section of the vehicle having the ability to be expanded and set up a tent that can be suspended to the trunks of trees.

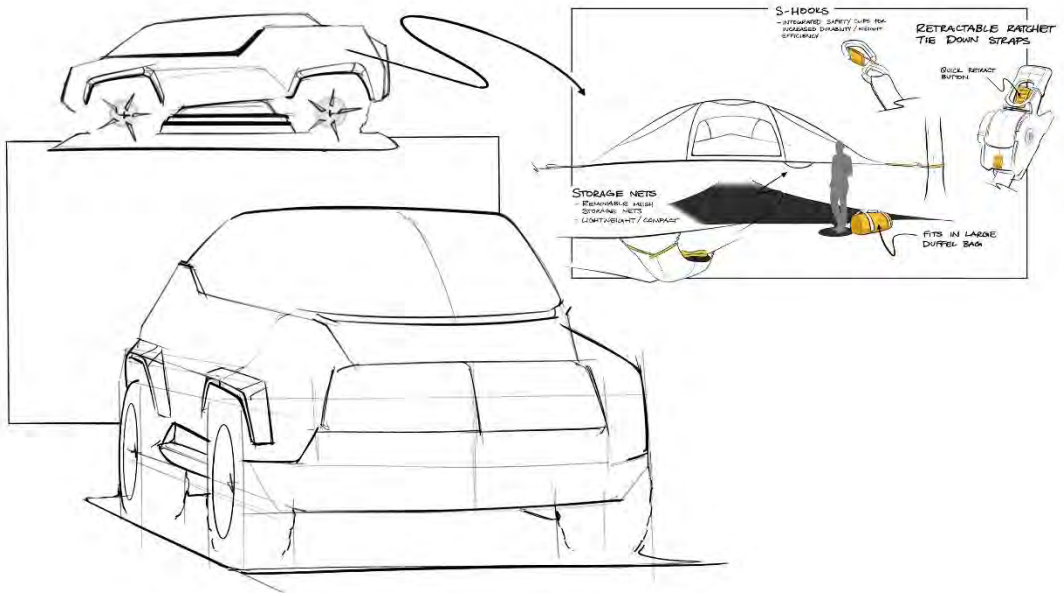


Figure 17: Concept Two – Off-Road Tree Camper

4.3 Concept Strategy

From this point, concept one was chosen to move forward with to continue to develop. Concept strategy covers the vision and goals that inform the design process, guiding decisions about form, function, and aesthetics. It serves as a roadmap for translating ideas into tangible design solutions that can address user needs.

4.4 Concept Refinement and Validation

The refined concept that was selected as the design direction to move forward with uses design cues from concept one but features a new approach. The primary design direction that was chosen to move forward with was the Open Concept Off-Road Camper.

4.4.1 & 4.4.2 Design Refinement and Detail Development

The refined concept uses a unique body shape, making it more unique and aesthetically pleasing. The “cutout” in the front of the vehicle (as shown in section 4.5.1 – Design Finalization) can be used as a bench to relax. This refined concept is amphibious, so whether the vehicle is on land or in the water, users can utilize this design element while enjoying nature. To enter the vehicle, the center spine of the vehicle which also doubles as a ladder to get to the roof of the vehicle to access the roof tent, expands and slides back towards the rear of the vehicle, creating an opening on both sides of the vehicle, allowing for users to enter from either side of the vehicle. The center spine of the vehicle is coated in a textured coating that is non-slip and provides extra grip when using it to get to the roof of ROAM. The main components of the interior are the seat, steering wheel, dashboard, kitchen unit, and bed. Starting from the front cab, the seat is fixed to an adjustable post,

and the seat is more of a seat pan than a complete seat. This allows for the user operating the vehicle to angle the seat as well as adjust the height, allowing them to operate the vehicle either standing and leaning on the seat, or sitting. The steering wheel is simple and easy to operate, keeping the focus elsewhere, the number of buttons on the wheel are minimized, with a small screen in the center, displaying information that can be customized by the user. The dashboard is modern, minimal, yet rugged, giving the interior a tough yet luxurious feel. The passenger side of the dashboard is hollowed out, allowing for the mounting of a hammock, allowing a passenger to relax and enjoy the ride. The kitchen unit consists of the following: Electric stovetop, sink, drawers for cutlery and dishes, as well as a refrigerator and freezer. All of these were compacted into one single unit, to not only maximize space but also increase practicality, functionality, and convenience. The fold-out bed be utilized either as a bench or a bed. When left as is, it can sleep one person, but when expanded, it can sleep two.

To summarize, the refined concept of ROAM is a unique and aesthetically unique design, featuring innovative elements. The vehicle's user-friendly features including the adjustable seat, minimalistic steering wheel, and compact kitchen unit, prioritize functionality, convenience, and comfort. With its versatile interior layout and practical design elements, ROAM promises an exceptional off-road camping experience.

4.4.3 Refined Product Schematic & Key Ergonomic

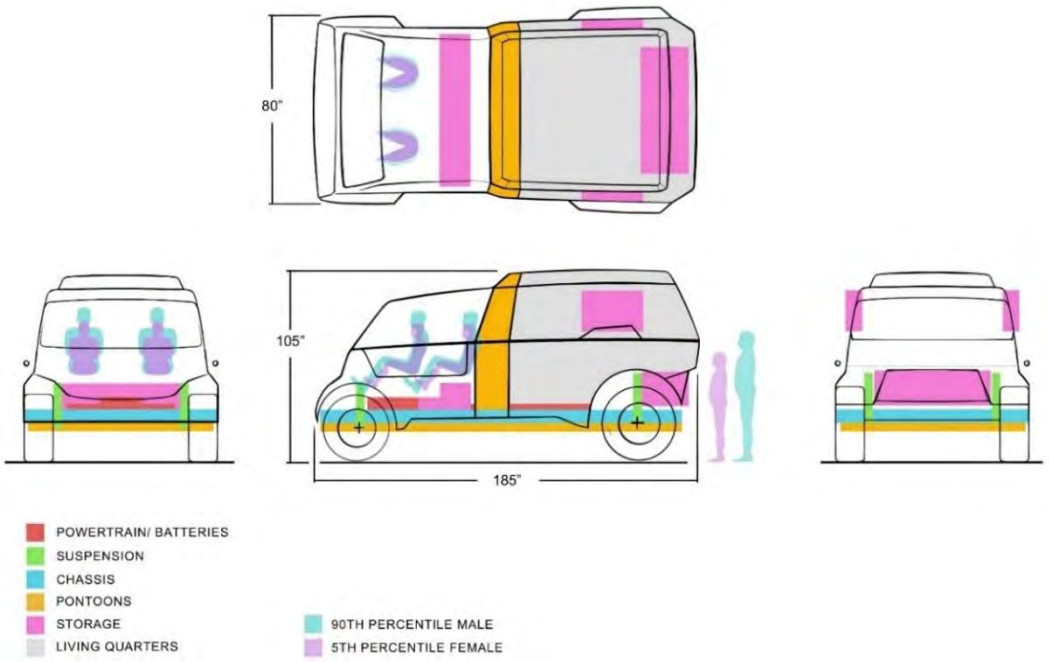


Figure 18: Schematic 1: Orthographic Views - Exterior

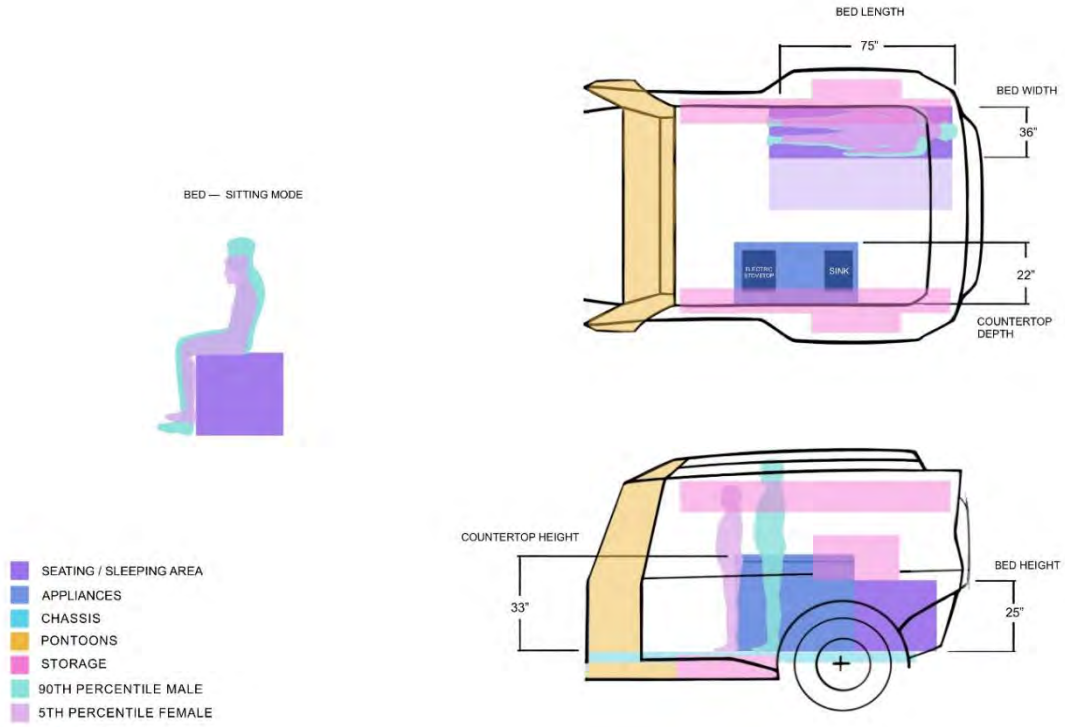


Figure 19: Schematic 2: Living Quarters

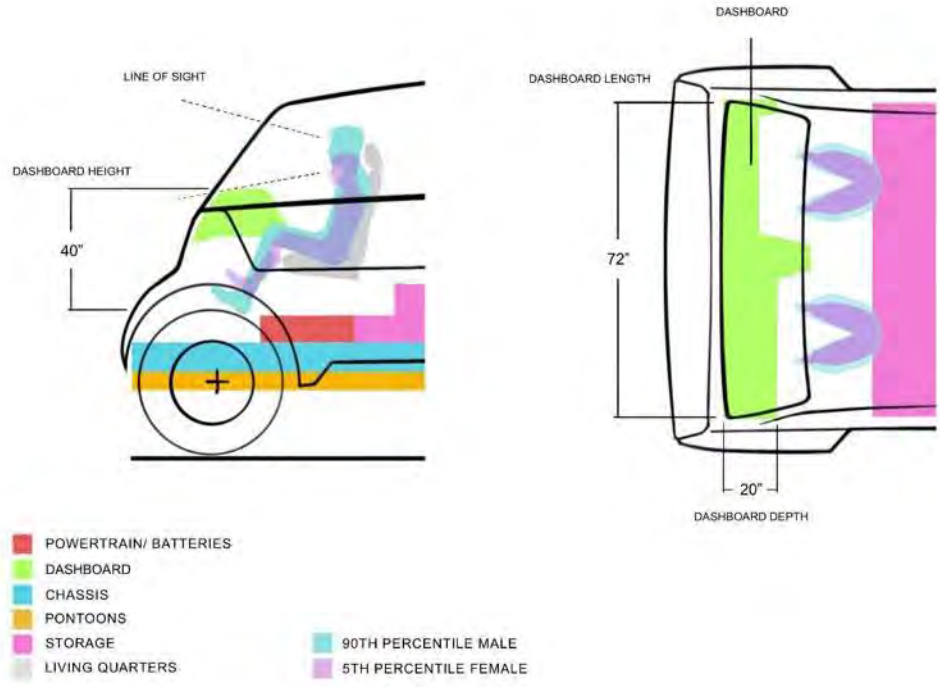


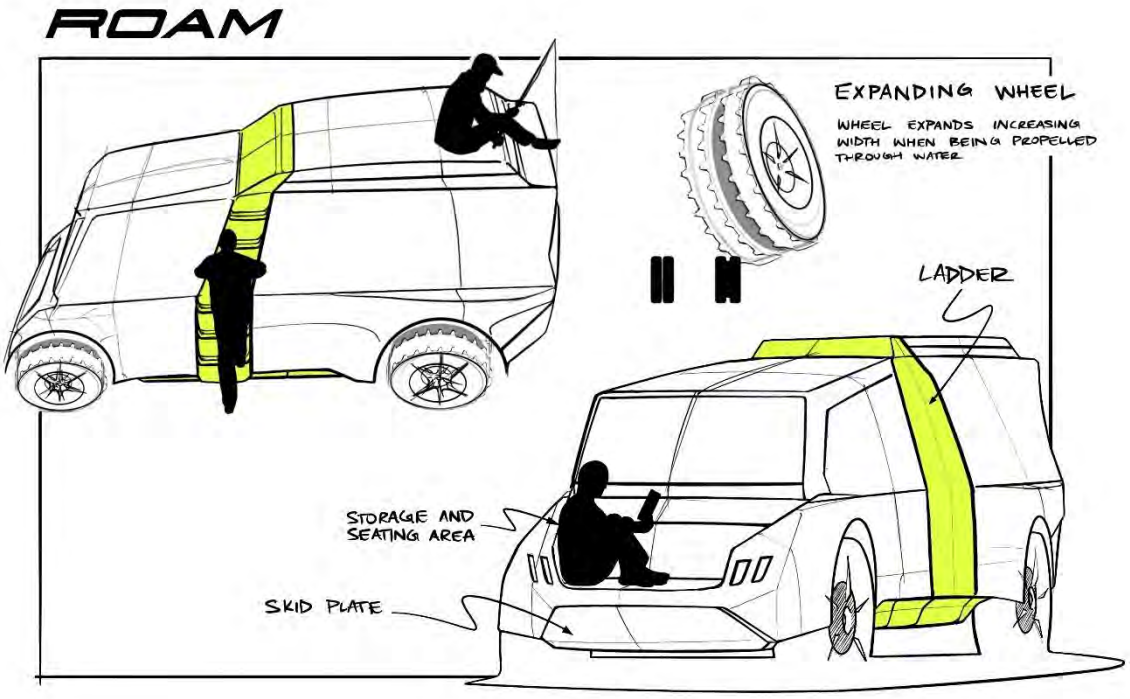
Figure 20: Schematic 3: Front Cab

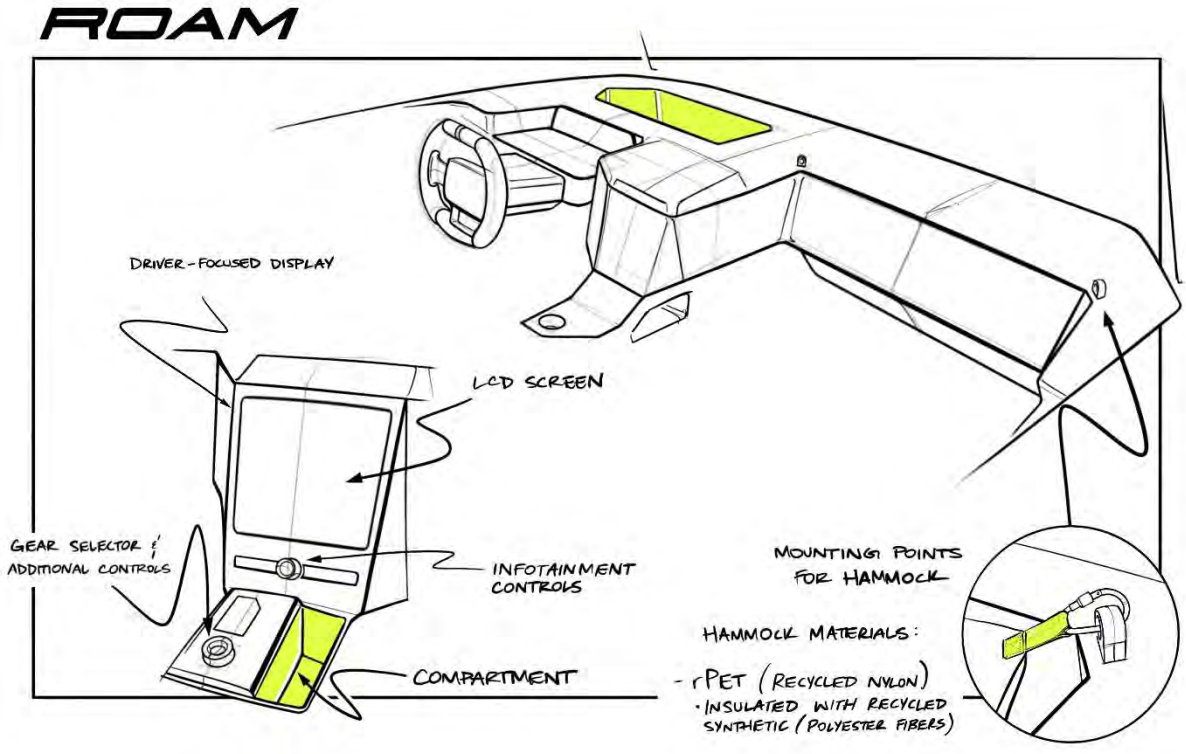
4.5 Concept Realization

This section will provide an overview of the design finalization of the vehicle, showcasing the final sketches before proceeding to CAD software. This segment dives into the creation of physical study models, which helped with playing a pivotal role in refining and shaping the final design direction.

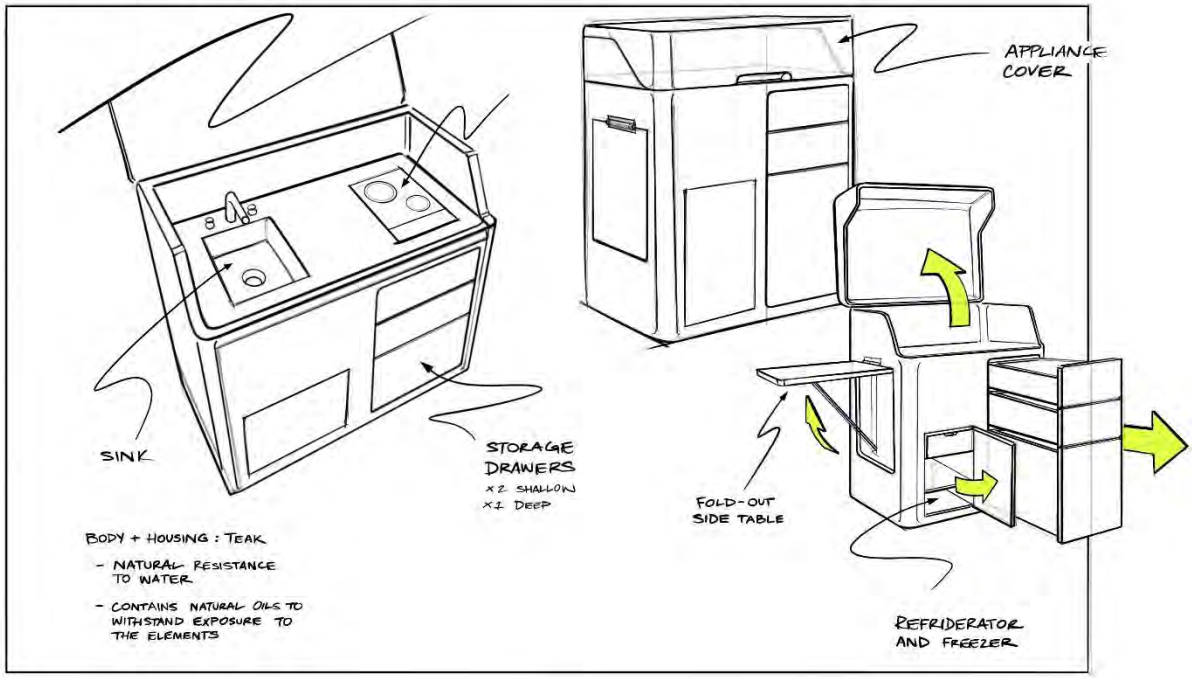
4.5.1 Design Finalization

These design finalization sketches display all features and functions of ROAM. The concept has been refined from the refinement stage, which can be found in section 4.4.1.

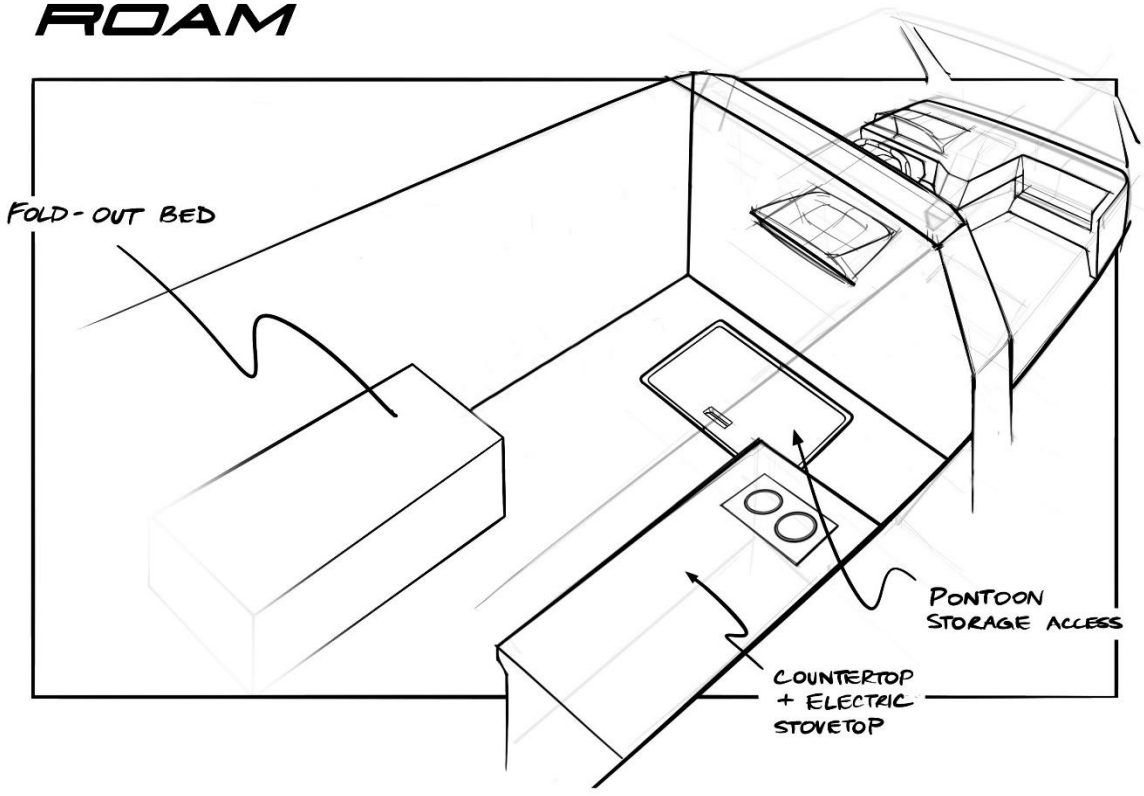

ROAM
EXPANDING WHEEL
WHEEL EXPANDS INCREASING WIDTH WHEN BEING PROPELLED THROUGH WATER
LADDER
STORAGE AND SEATING AREA
SKID PLATE


ROAM
DRIVER-FOCUSED DISPLAY
LCD SCREEN
GEAR SELECTOR & ADDITIONAL CONTROLS
INFOTAINMENT CONTROLS
COMPARTMENT
MOUNTING POINTS FOR HAMMOCK
HAMMOCK MATERIALS:
- rPET (RECYCLED NYLON)
· INSULATED WITH RECYCLED SYNTHETIC (POLYESTER FIBERS)

ROAM


APPLIANCE COVER
SINK
STORAGE DRAWERS
x2 SHALLOW
x1 DEEP
FOLD-OUT SIDE TABLE
REFRIDERATOR AND FREEZER
BODY + HOUSING : TEAK
- NATURAL RESISTANCE TO WATER
- CONTAINS NATURAL OILS TO WITHSTAND EXPOSURE TO THE ELEMENTS

ROAM


FOLD-OUT BED
PONTOON STORAGE ACCESS
COUNTERTOP + ELECTRIC STOVETOP

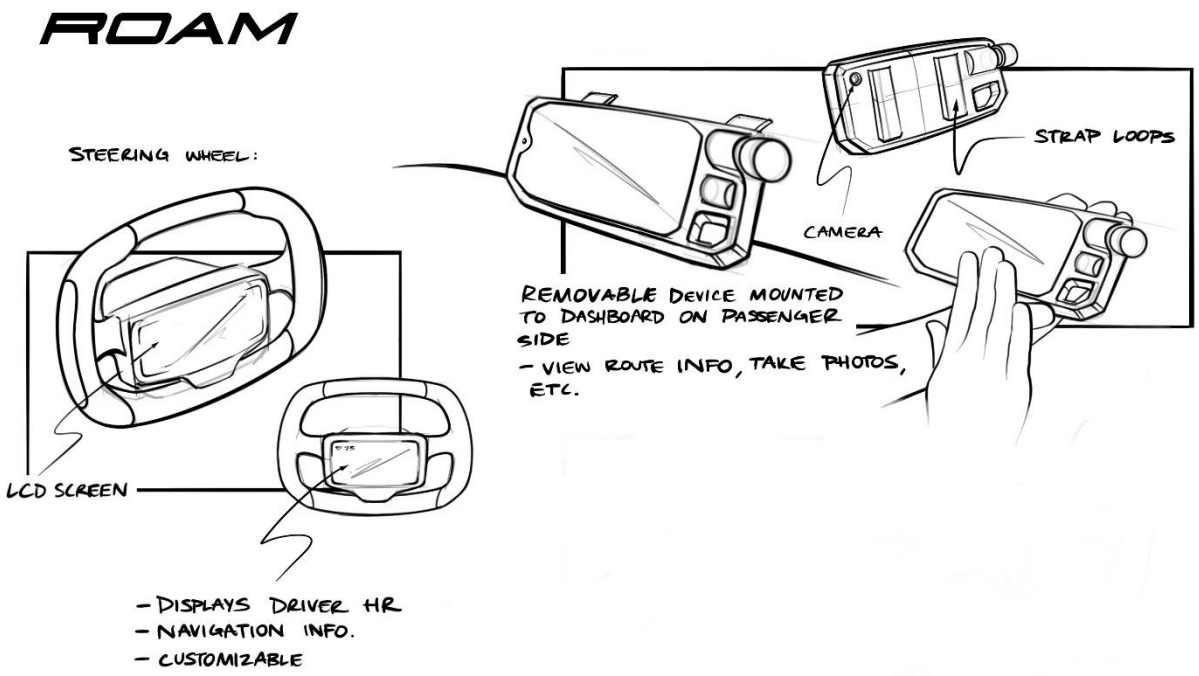
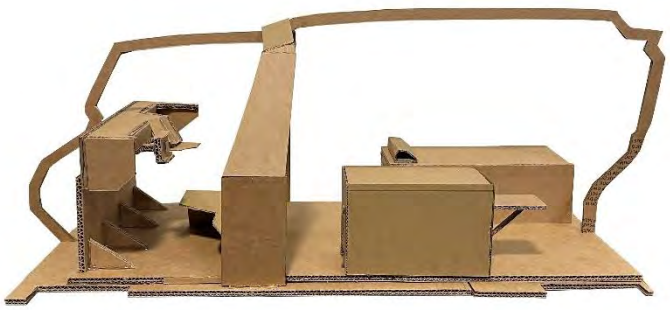


Figure 21: Design Finalization Sketches

4.5.2 Physical Study Models

To gain a better understanding of the interior layout of the vehicle, a physical study model was constructed in 1:5 scale. This really helped with informing the final size of the vehicle along with figuring out the final placement of interior components such as the kitchen unit or fold-out bed. Cardboard was used to construct the entire model. Building a scaled model helped identify potential issues with the placement of components in the interior of the vehicle. Once this study was complete, minor adjustments and revisions were made before officially starting the CAD modeling process.



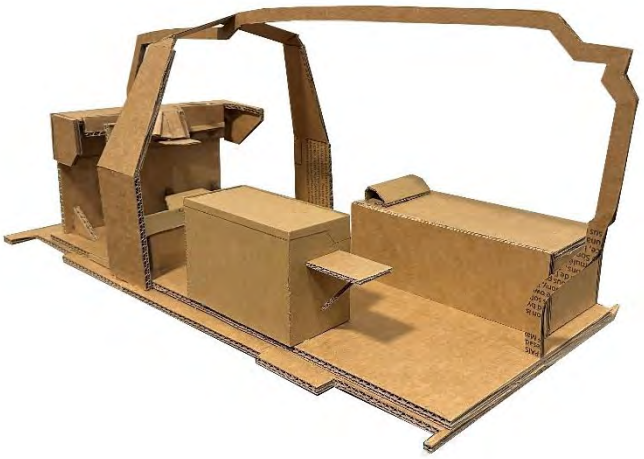


Figure 22: Physical Model Study

4.6 Design Resolution

In the design resolution phase, a comprehensive understanding of the design's human interaction, functionality, value, and aesthetic approach is essential before transitioning into the digital world of CAD. This involves synthesizing all conceptual ideas, ergonomic considerations, and user feedback to ensure that the final design addresses the needs and desires of the target audience effectively. By thoroughly evaluating the design's feasibility, practicality, and alignment with project objectives, any potential issues or challenges can be identified and addressed early on. A holistic approach ensures that the final design is robust, user-centered, and well-suited to meet the demands of off-road ecotourism while embodying sustainability principles and aesthetic appeal.

4.7 CAD Development

Undertaking the CAD development took an approximate total of 8 weeks to complete, and SolidWorks was the main software that was used to model the design, and Blender was also used towards the end of the modeling progress. The initial process began with importing the vehicle's schematic into SolidWorks, and once scaled properly, it was time to begin. For this project, surface modeling was the method that was primarily used. This made it relatively easier as it allowed for slightly more flexibility when working on more detailed components. Despite some issues along the way with some of the surfacing of the main body and getting the body to form nicely, the form was resolved, and the CAD model was coming together nicely. Some minor setbacks in the earlier stages were later resolved in the final design where the headlights did not sit in the front end properly. Getting the center spine to flow into the roof tent and sit flush with the sides of the vehicle all at the same time was challenging, but with due time it came out looking great. Some drawbacks with the CAD model were not having as much time to detail the interior as much as I detailed the exterior.

Having the additional time to further detail the interior elements such as cabinetry, modelling a extendable bed to showcase its ability to fold out, and just small finishing details to really elevate the interior even further.

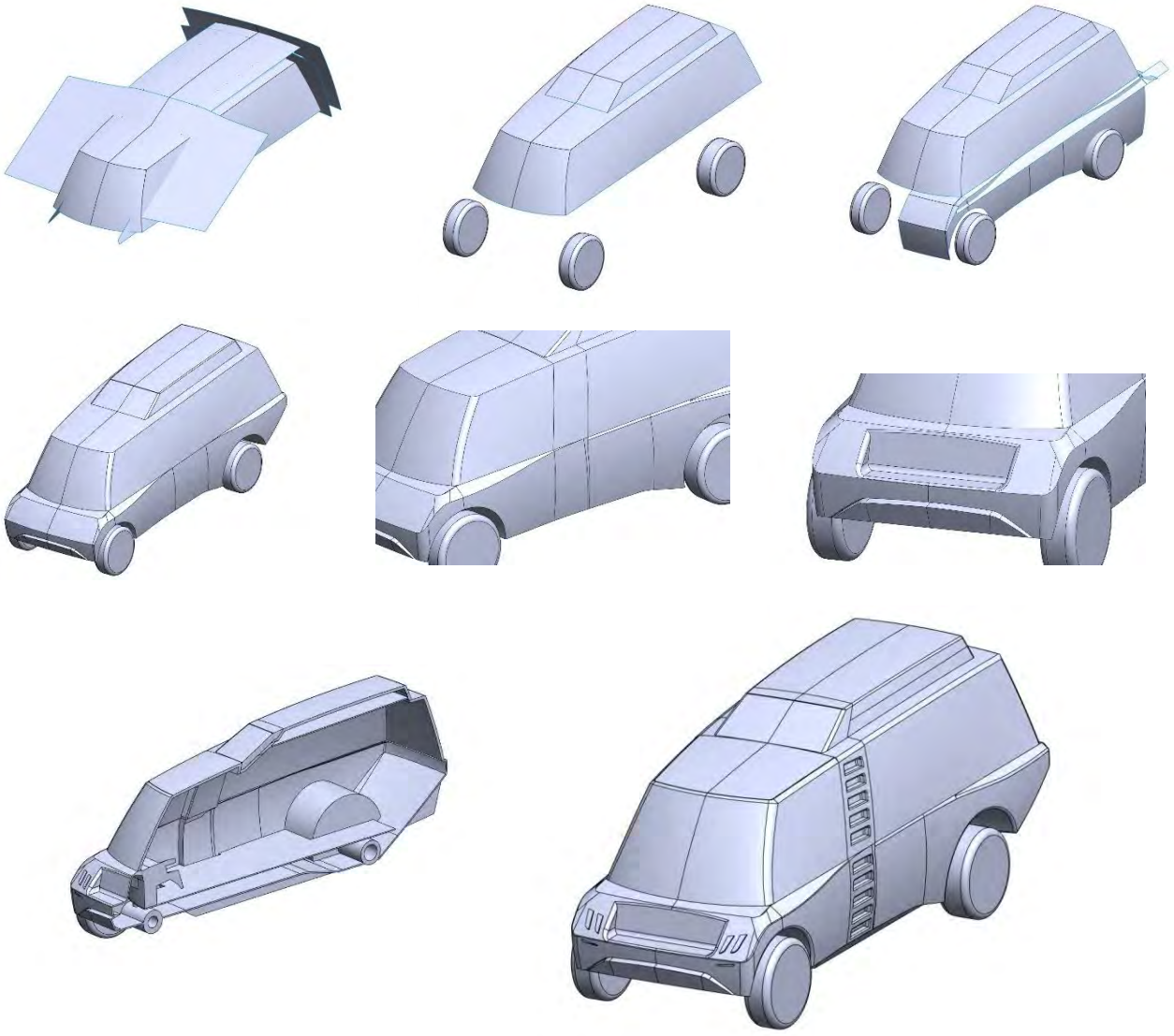


Figure 23: CAD Development

4.8 Physical Model Fabrication

After the completion of the CAD modeling, the design was then prepared and sent to be 3D printed. The print of the model was outsourced to local 3D printing company Agile Manufacturing. The model was printed at 1:10 scale with Stereolithography (SLA), a 3D printing technology that polymerizes a liquid photopolymer resin one layer at a time. Having the model printed in this material was beneficial keeping intricate details in the design of the model as well as with the smaller components of the model. Although this material is higher quality than PLA for example, sanding was still done to smoothen surfaces further and attempt to increase the overall quality of the main components of the model. Along with SLA, the wheels of the vehicle were printed in black using MultiJet Printing. Once sanding was done, all components were primed with grey, and it was time to start painting. The main body of the vehicle was painted in a warm light grey, similar to off white; with the roof tent, exterior rear storage, center spine, and pontoon underbody being painted in a shade of yellow. Due to not being able to find the correct shade needed to paint the turbofans attached to the wheels, a custom dark blue green paint was made to contrast with the decals and roof tent fabric. The upper and lower sections of the main body were masked off using painters' tape and the interior walls and dashboard of the vehicle were painted flat black. The interior flooring was covered using a textured hardwood veneer sheet to replicate the wooden laminate flooring, with the same material used on the interior kitchen unit drawers. The fabric for the roof tent was from a pair of women's leggings that were cut up, reinforced along the top and bottom of the tent using styrene tubing, and the hydraulic struts that are visible on the sides were also made from styrene tubing.

Figure 24: Physical Model Fabrication

CHAPTER 5: FINAL DESIGN

5.1 Design Summary

ROAM (Remote Off-Road Amphibious Mobility) is an off-road vehicle made for ecotourism. This vehicle utilizes sustainable features and practices that address the ecological degradation associated with off-road ecotourism in Nova Scotia. Ecological degradation not only poses a threat to the region's ecosystems, but also reduces the sustainability of the tourism sector. ROAM not only provides a different and unique perspective when spending time in nature, but also promotes sustainable practices. This vehicle features sleek exterior design characterized by angular lines and robust contours, reflecting its rugged yet sophisticated nature. The interior layout is thoughtfully crafted to maximize space and functionality, featuring customizable seating and ample storage solutions. Advanced technological features, including a state-of-the-art navigation system and connectivity options, ensure a seamless and enjoyable journey for users. The ergonomic cabin layout of ROAM prioritizes ergonomic principles, offering ergonomic seating positions and intuitive user-friendly control interfaces to minimize fatigue during extended off-road journeys. Sustainable materials and manufacturing processes are incorporated throughout the vehicle, emphasizing the commitment to environmental stewardship. Airless tires reduce the vehicle’s carbon footprint during production; moreover, their improved rolling resistance can lead to reduced emissions over the tire’s lifespan. Along with the airless tire’s ability to expand, allowing ROAM to go from a narrower wheel to increase passability in tighter situations to a wider tire for increased stability, turbofans integrated into the face of each airless tire help propel ROAM through water. Solar panels along the top of the roof tent are used to help power some amenities in the cabin, and sustainable materials such as Piñatex, recycled plastics, and more are used to further promote sustainability. ROAM includes unique features that separate it from existing options, allowing people the opportunity to

experience nature for longer periods of time in comfort while exploring nature in a vehicle that has a reduced environmental footprint. The future findings of this study will offer invaluable insights into the effectiveness of sustainable off-road ecotourism practices. These insights, derived from the evaluation of specific design solutions and their consequences, will serve as a linchpin in guiding Nova Scotia towards an environmentally conscious and economically resilient future. The final design of ROAM represents a significant leap forward in off-road vehicle innovation, offering users exceptional comfort, convenience, and peace of mind. By prioritizing ergonomics, sustainability, and technological advancements, ROAM not only meets the diverse needs of modern adventurers, but also sets a new standard for responsible and immersive off-road experiences.

5.2 Design Criteria Met

5.2.1 Full Bodied Interaction Design

Ergonomic dimensions play a significant role in shaping the overall user experience within the vehicle. By carefully considering anthropometric data and ergonomic guidelines, the design incorporates dimensions that accommodate a wide range of body sizes and postures. Seat height, depth, and width were optimized to provide adequate support and minimize discomfort during prolonged journeys. Control interfaces are positioned within easy reach, enabling users to operate essential functions without straining or stretching. The main touchpoints are the arms and hands when operating the digital interfaces in the dashboard, arms and hands when using the kitchen unit, and torso, legs, and feet when using the fold-out bed to either sit or sleep. The design effectively meets the selected criteria for full-bodied interaction by prioritizing user comfort, accessibility, and usability. The incorporation of ergonomic dimensions ensures that users can engage with the vehicle in a comfortable, relaxed manner, providing a positive and immersive off-road experience.

5.2.2 Materials, Processes and Technology

In this section, the materials, technology, and processes used in this project's design will be discussed. Components of the vehicle will be separated and broken down individually:

Vehicle Body

High-strength steel is highly recyclable, with most steel used in automotive applications containing recycled content. Recycling steel reduces the demand for virgin materials and energy consumption associated with primary steel production. High-strength steel allows for lightweighting without sacrificing strength, which can improve fuel efficiency and reduce greenhouse gas emissions over the vehicle's lifecycle. Vehicles constructed with high-strength steel are durable and long-lasting, extending their operational lifespan and reducing the need for premature replacement.

Flooring

Wood Laminate is often made from sustainably sourced wood fibers or recycled wood materials. Using certified sustainable wood ensures responsible forestry practices and helps protect natural habitats. Wood laminate production consumes less energy and water compared to solid wood products. It also minimizes waste by utilizing wood scraps and residues from other manufacturing processes. Wood laminate also offers the natural beauty of wood while providing greater flexibility in terms of colour, texture, and pattern. It can mimic the appearance of exotic wood species without contributing to deforestation.

Piñatex

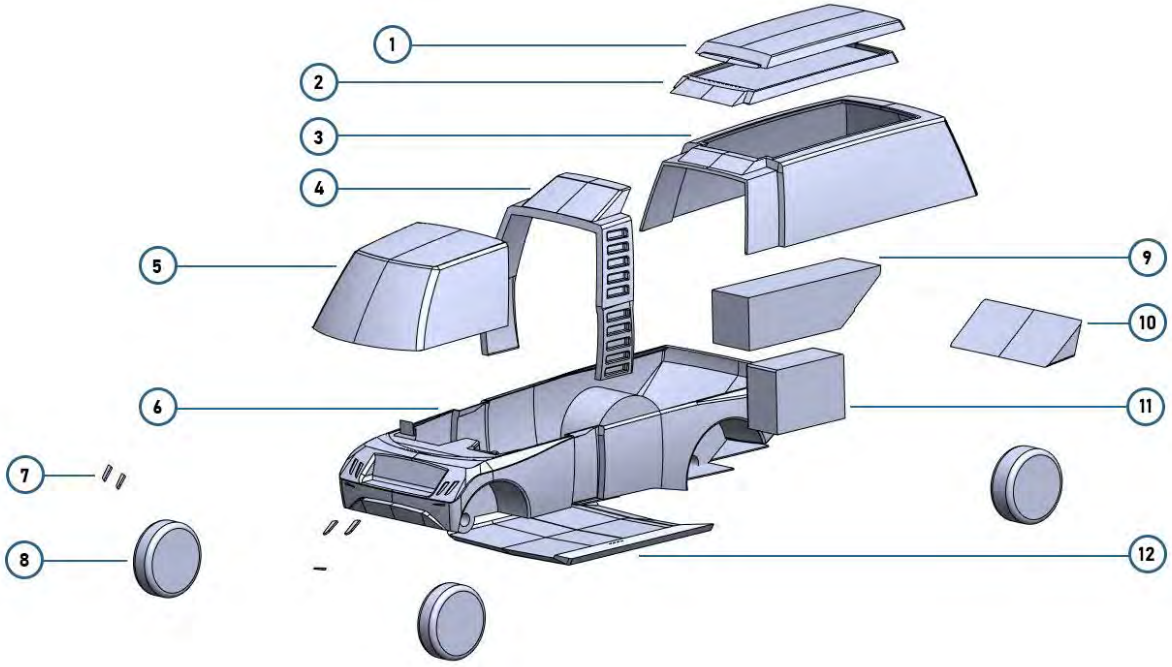
Piñatex is made from pineapple leaf fibers, a natural byproduct of the pineapple industry. Using these fibers reduces waste and promotes sustainable agriculture practices. Piñatex production requires fewer resources compared to traditional leather, such as water and chemicals.

It avoids the environmental impacts associated with animal farming. Piñatex is durable and versatile, making it suitable for various applications.

Airless Tires

The airless tires are made of recycled rubber. Made from discarded tires, this helps reduce waste and minimize environmental impact. By repurposing existing rubber materials, this sustainable approach conserves resources and reduces the need for new raw materials. Additionally, recycled rubber tires can offer comparable performance to traditional rubber compounds, providing excellent durability, traction, and resistance to wear and tear. This makes them suitable for use in airless tires, where reliability and longevity are essential.

5.2.3 Design Implementation



Part #	Description	Qty.	Material	Finishing	Manufacturing Method
1	Roof Tent – Top	1	Aluminum	Textured	Aluminum Extrusion
2	Roof Tent - Bottom	1	Aluminum	Textured	Aluminum Extrusion
3	Body – Top	1	High-Strength Steel	Semi-gloss	Stamping, Welding
4	Center Spine	1	High-Strength Steel, Textured Rubber Coating	Matte, Textured	Stamping, Welding
5	Front Cab Glass	1	Laminated Safety Glass	Translucent, UV Protected	Autoclaving bonding
6	Body – Bottom	1	High-Strength Steel	Matte, Coated	Stamping, Welding
7	Headlights	6	Polycarbonate	Semi-gloss	Injection Molding
8	Airless Tires	4	Recycled Rubber	Texturing, Coating, Sealing, Vulcanization	Injection Molding
9	Bed	1	Aluminum	Brushed	Extrusion, Welding
10	Rear Storage	1	HDPE	Semi-gloss	Injection Molding
11	Kitchen Unit	1	Coated Laminate/ Recycled Aluminum	Matte, laminate in coated semi-gloss	Welding
12	Pontoon Underbody	1	Aluminum	Matte, Surface Coated	Extrusion, Welding

5.3 Final CAD Rendering

Interior Access – Closed

Interior Access – Open

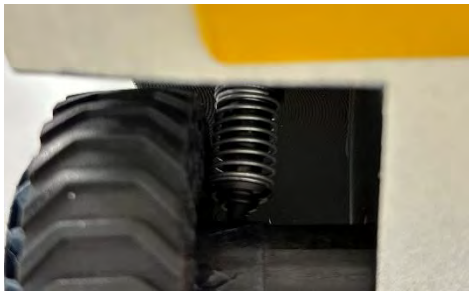
Roof Tent -- Open


OPEN MAPS

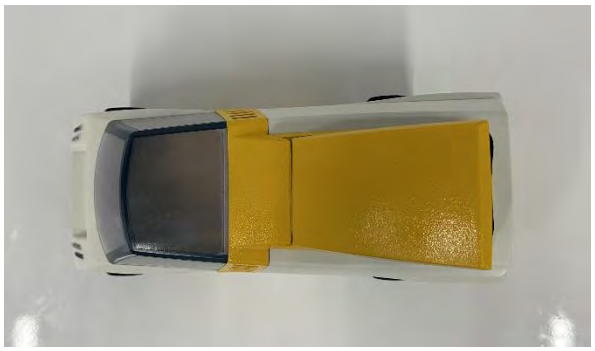
5.4 Physical Model



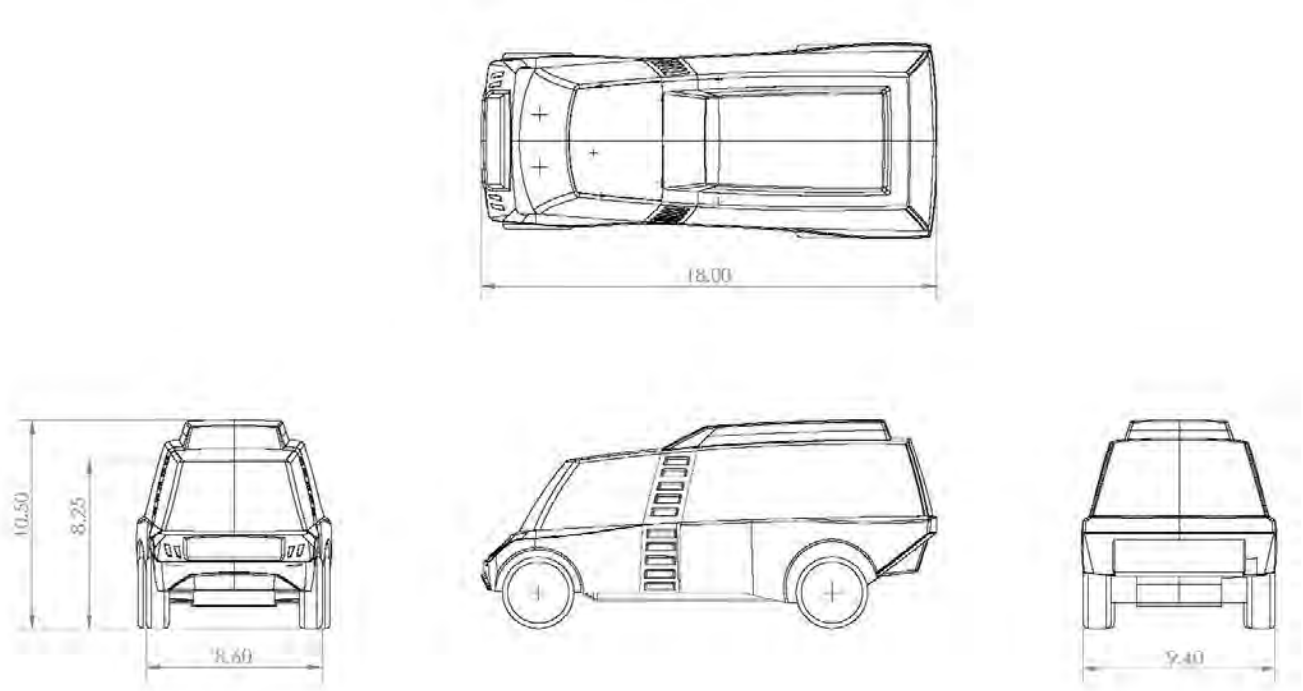






5.5 Technical Drawings



**Technical Drawing of ROAM in 1:10 scale*

5.6 Sustainability

The design of an off-road camping vehicle for ecotourism in Nova Scotia embodies sustainability principles across multiple facets, ensuring a harmonious balance between environmental responsibility and functional efficacy. Sustainability is important for the success of this thesis. Without careful consideration of sustainability during the early stages of design, the future holds shocking consequences. Continued reliance on non-renewable resources and unsustainable practices will lead to further depletion of natural resources, environmental degradation, and heightened climate change impacts. This could result in irreparable damage to ecosystems, the loss of biodiversity, and the exacerbation of social and economic inequalities. Without sustainable design practices. Future generations will inherit a planet that is increasingly

uninhabitable, and resources depleted. Therefore, prioritizing sustainability in design is crucial for ensuring a viable and prosperous future for all.

In terms of materials, careful selection has been made of lightweight and durable options such as aluminum and high-strength steel, reducing fuel consumption, and enhancing longevity while minimizing environmental impact. Additionally, the incorporation of recyclable polymers and plastics such as polypropylene, polyethylene, and ABS further emphasizes the commitment to resource efficiency and waste reduction. Manufacturing processes prioritize closed-loop systems where it is possible to minimize waste and energy consumption. Advanced technologies and efficient production methods are employed to optimize resource utilization and reduce. carbon emissions throughout the vehicle's lifecycle. The exploration of sustainable business models aligns economic incentives with environmental objectives. Emphasizing the long-term benefits of sustainability and fostering partnerships with eco-conscious stakeholders aim to create a business ecosystem that promotes environmental stewardship and economic viability in tandem.

Sustainability lies at the core of the design for an off-road camping vehicle for ecotourism in Nova Scotia. By incorporating sustainability principles across various aspects, the design achieves a harmonious balance between environmental responsibility and functional efficacy.

CHAPTER 6: CONCLUSION

In conclusion, the design presented in this project emerges as a commendable solution poised to address the identified challenges in the world of off-road ecotourism effectively. By addressing the problem definition, centered on mitigating ecological degradation stemming from off-road ecotourism, the design demonstrates a holistic approach towards sustainability and responsible tourism. Through the integration of eco-friendly features, ergonomic considerations, and a focus on user-centric design, this product successfully fulfills its intended purpose while aligning with broader environmental goals.

The design's efficacy is emphasized by its ability to provide enhanced user experiences, promoting comfort, safety, and well-being during off-road adventures. The incorporation of safety features, ergonomic layouts, and environmentally conscious materials ensures that users can navigate diverse terrains with confidence while minimizing their ecological footprint.

To summarize, the design not only addresses the pressing environmental concerns associated with off-road ecotourism, but also delivers tangible benefits to users and stakeholders alike. By fostering a harmonious balance between environmental stewardship, user satisfaction, and economic viability, the design sets a precedent for sustainable practices in the realm of off-road exploration. As such, it stands as a testament to the potential of innovative design solutions to contribute positively to both the preservation of natural ecosystems and the enhancement of human experiences.

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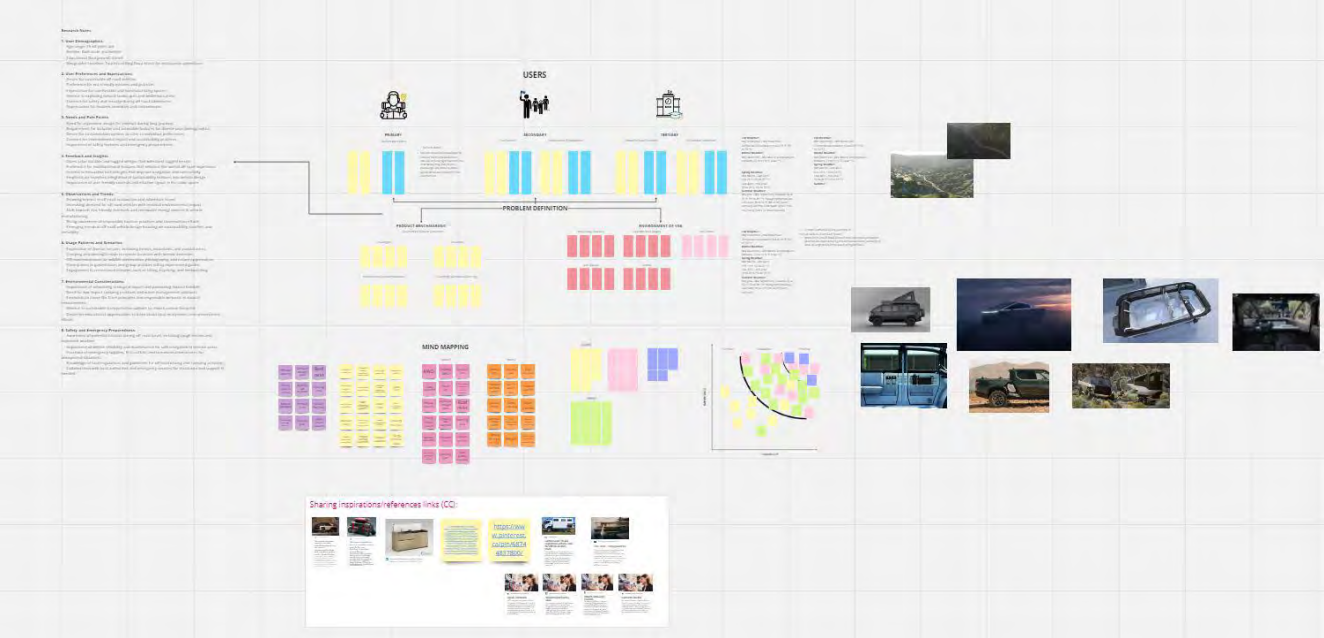
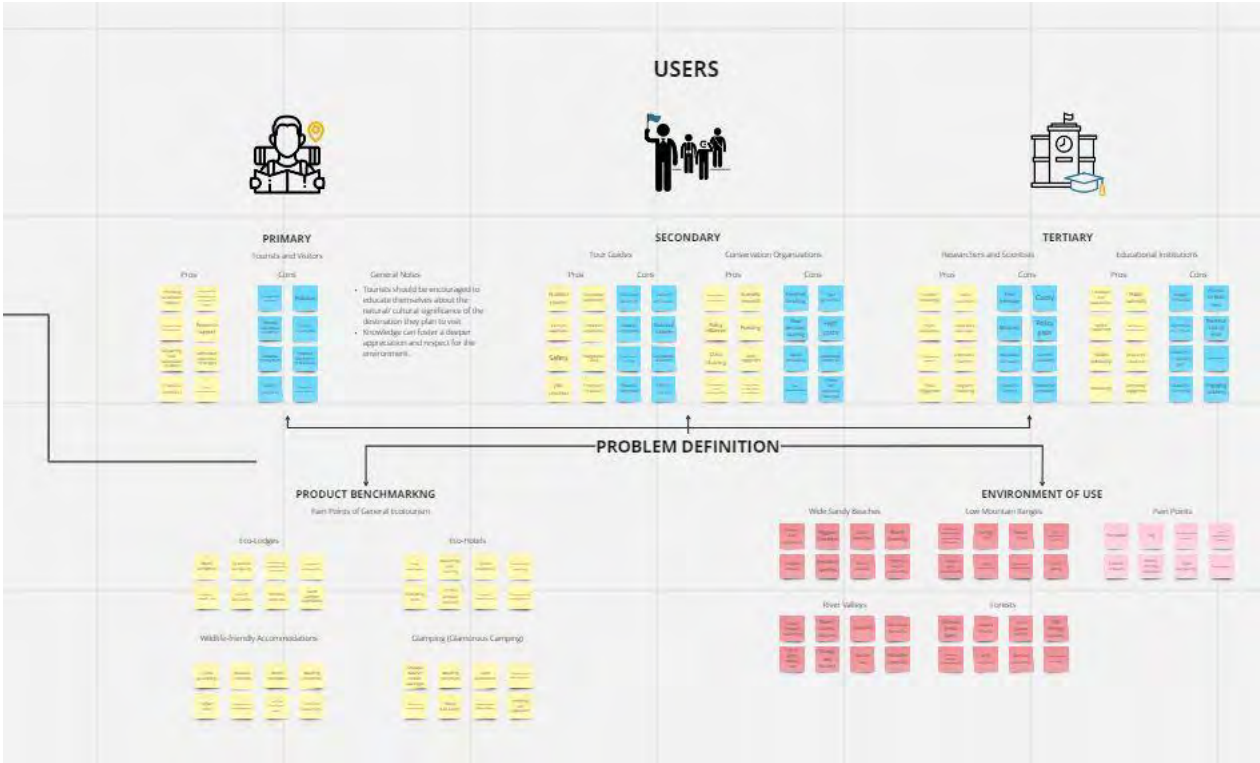
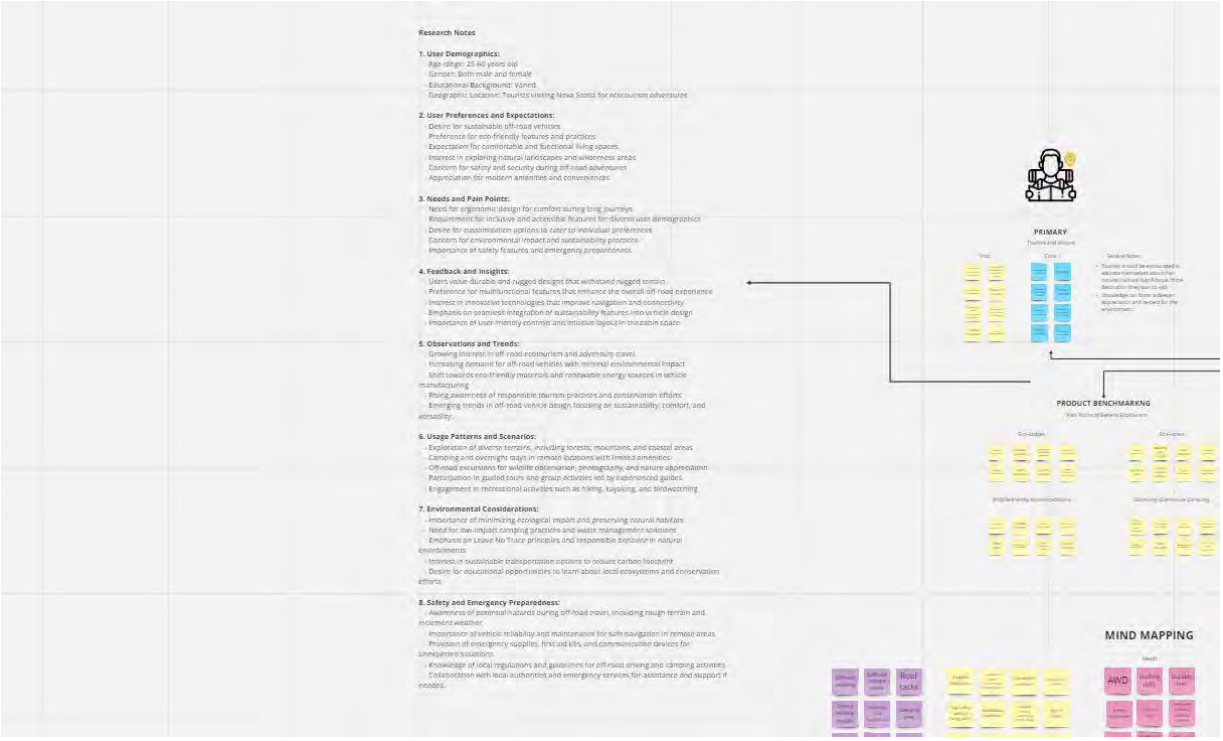
Appendix A: Discovery





Appendix B: User Research



Appendix C: Field Resarch (Product)

Summary: How this may inform design

- Unique places to stay
- Connecting with nature
- Avoiding crowds
- Vehicle considerations

Video Observed: *"How to Start Overlanding in 2023: A Beginner's Guide to Basics So You Can Start to Overland TODAY"*

*URL:*https://www.youtube.com/watch?v=0FZq4QOoCag&ab_channel=GGG4Runner

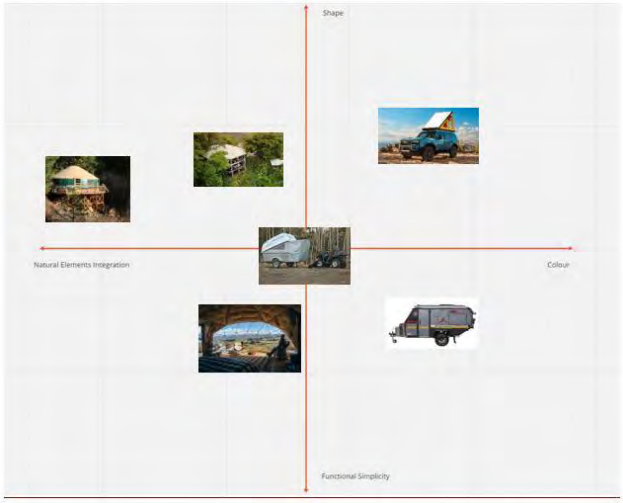
Date Uploaded: December 10th, 2022

How to Start Overlanding in 2023: A Beginner's Guide to Basics So You Can Start to Overland TODAY https://www.youtube.com/watch?v=QFZqdQOoCag&ab_channel=GQG4Runner		

Time	Physical Space	Say	Do / Other	Do - Socialize	Attitude: Positive	Attitude: Negative
0:10	Driveway	Introduction			Intrigued	
0:40	Sitting in car	Starting to list things needed to overland		Hand gestures		
1:20	Forest Trails, open spaces near mountains, steep/ rugged terrain	Have your vehicle in consideration with the terrain you plan to adventure on	Driving on trails in the forest, through water, and off-road crawling in a vehicle			
3:00	Sitting inside house	Using your vehicle as shelter benefits of ground tents, other alternatives, etc				
5:00	Outside at table	Talking about food supply and cooking, burner recommendations, etc	Demonstrating boiling water in a kettle with different-sized burners			
7:00	At a picnic table	Water filter recommendations	Demonstrating water filter			
9:00	Screen recording	Apps to use to navigate without service	Showing different apps that can be useful without a connection/ service		Very convenient	
11:10	Sitting in house	Create a checklist and go over ahead of time	Showing examples of checklists			
12:00	Sitting in house	It is highly encouraging to pick up after yourself/clean up waste	Showing products that aren't harmful to the environment		Can be costly to replace with and really dis courages cleaning up after yourself	
15:00	In garage	How to protect supplies/ food from animals	Showing products that the creator would recommend			
17:20	Driveway	Recapping the things needed to start Overlanding	Leaning on an off-road truck	Suggesting checking out other videos on their channel		

Coding

Time	Location	Do	Say	Social Interaction	Positive	Negative
Sunset	Camping Grounds	Thumbnail	Teaching how to start Overlanding			
			List of things you'll need to start			
			An in-depth look at each item listed			
Another day, late morning/ afternoon?	Forest	Driving on off-road/ rugged trails	Keep the vehicle you will be driving into consideration when deciding what trails you will be driving on			
Mid-day	In house	Carry some sort of satellite phone	For the need for communication in emergencies	To communicate with others/ get help if needed	Enhances safety and allows for communication in remote locations	
		First aid kit, tourniquet, fire extinguisher	Importance of safety equipment	Emergency Preparedness	Provides essential tools for addressing medical and fire emergencies	
Waste Disposal	Garage	Proper waste disposal	Eco-friendly waste management	"Leave no trace" principles	Preserves the environment by minimizing waste impact	
Food Storage	Garage	Storing food properly (i.e. airtight buckets, etc.)	Importance of proper food storage and preservation	Food sharing with locals	Food remains fresh	
Personal Hygiene	Outside	Importance of personal hygiene	Maintaining cleanliness in the wilderness	Interactions with others	Ensures a more comfortable and hygienic experience during travel	



Interface Takeaways

a) Screen interfaces
b) Digital touch display
c) Touch points (knobs, screens, etc.)
d) Assist in preparation/ setup to lighten load on user

Need Type	Product Benefits (marketing)	Human Needs (psychology)
Immediate Needs		
	Marketing- Existing Need Short term • Off-road capability • Ease of setup • Security features	**Psychology- Unfulfilled Human Needs** **Pain point alleviation:** • Safety • Practicality • Self-preservation
Latent Needs	Latent needs are **unknown**, the user being unaware of them	
	Examples of latent product benefits **Breakthrough Products** • Self-Deploying Camping Trailers • AI-Integrated Navigation Systems **Unanticipated Experience** • Wildlife encounters in remote locations • Effortless setup in challenging environments • Safety features in unexpected situations • Ease of handling off-road terrain	***Examples of latent needs*** **Fundamental human needs (Maslow)** • Self-fulfillment • Self-expression • Belongingness ***'Hidden Persuaders'*** • Self-actualization through exploration • Esteem and pressure • Safety as a basic need • Competence and Mastery
Wants / Wishes		
	Marketing- a.k.a. Incipient Needs • Unique modifications • Luxury amenities • Aesthetic appeal • Marketing allure	**Psychology- Unfulfilled Human Needs** ***Self-Fulfillment:*** The desire for self-fulfillment while overlanding could manifest as a quest for personal growth, seeking unique experiences, and discovering one's potential through adventurous journeys. ***Self-Expression:*** Overlanding allows individuals to express their identities' passions through customized rigs, unique modifications, or documenting and sharing their journeys via social media or creative outlets. The desire for self-expression might be reflected in the way adventurers personalize their vehicles or share their stories, embracing their individuality within the off-road community. ***Belongingness:*** Overlanders often seek a sense of community and shared experiences with like-minded enthusiasts. They may join forums, attend meetups, or engage in group adventures, all driven by the need for deeper social connections and a sense of belonging within the overlanding community. ***Social status:*** In the world of off-road gear, a preference for recognized brands mirrors the quest for esteem and acknowledgment. It reflects a desire for validation within the off-road community, indicating a yearning for recognition and status among peers. The appeal of owning prestigious gear subtly hints at the unmet need for external validation and recognition within this niche group. ***Intrinsic Pleasure:*** The longing for intrinsic pleasure and the freedom to explore resonates with self-actualization in off-road adventures. It reflects a pursuit of genuine experiences and personal growth, signifying a deeper need to embrace the full spectrum of outdoor living beyond material possessions. This desire to roam freely embodies a quest for self-actualization, aligning profoundly with the essence of off-road exploration.

Aesthetic Takeaways

Shape and Size:

- Geometrical/ rectilinear forms are popular
- Rounded edges with majority of off-road living vehicles

Colour:

- Shades of grey are very popular
- Natural tones such as desert sand, military green, navy blue, etc. are also popular choices
- Colours that tie into nature/ relate in some way

Natural Elements Integration:

- Featuring the integration of natural elements or nature-inspired design features
- Whether it be the incorporation of natural materials (wood, stone), natural tones/ colour schemes or designs that blend with outdoor environments, this might emphasize a connection to nature and aesthetic presentation

Functional Simplicity:

- Having a focus on functional simplicity and utilitarian design aesthetics
- Possibly exhibiting design features that can prioritize practicality, minimalism, and functionality over excessive or complex design elements

Appendix D: Result Analysis

Step 1

Making a List

1. Highlighting the need to consider additional items other than essentials such as recovery gear and water solutions when overlanding as opposed to regular camping.
2. Possibly packing other useful items such as a folding table, garbage bags/ something to dispose garbage into, etc.

Points of contact:

3. Inventory Check: Creating that main list listing everything from camping gear, food supplies, tools, etc.
4. Packing Strategy: Noting the approach taken by the user to organize gear, categorize items, and plan their placement within the vehicle/ storage compartments.
5. Vehicle Inspection: Conducting a pre-trip vehicle check, including fluid levels, tire pressure, and making sure the vehicle is in optimal condition for off-road travel.

Step 3

Packing Execution

8. Sleeping arrangements within vehicle, observing, and keeping user's preferences for comfort and convenience in consideration
9. Observing user's organization of kitchen/ related supplies, including cooking utensils, stove setup, food storage, meal prep procedures, etc.
10. Paying attention to storage optimization, utilization of compartments and storage solutions, and ensuring easy access to frequently used items

"Leave no Trace"

Step 2

6. When camping, there are usually dump sites for campers to dispose of garbage, but when overlanding and being in more remote locations, "leave no trace" is a rule that is usually known by more people who are experienced overlanders. Essentially meaning pick up and take all garbage with you and leaving the grounds the way you found them if not better. So, preparing and packing a product such as a "trashcon" or similar is important to take garbage with you with ease.
7. He is forced to bend his back and knees, so he doesn't hit his head on the exterior of the cab.

Final Preparations – Last Minute Adjustments

Step 4

11. Making any last-minute adjustments or additions to packing arrangements based on situational requirements, or changing needs

Step 5

Safety Checks and Emergency Equipment

12. Observing the user's preparation of emergency kits, first aid supplies, communication devices, and safety equipment (ensuring additional preparedness for any possible unforeseen situations)

Departure Readiness

Step 6

13. Documenting any final checks/ preparations of packing before officially leaving to go overlanding and off-road listing
    - Will provide comprehensive insights into the user's planning, organization and execution of preparations for extended camping excursions

Survey of Users - Results

How many times respondents have been Overlanding

- Only once
- Two times
- 3-5 times
- Over 10 times

Q1

How often respondents go Overlanding

- Very Rarely
- Occasionally
- Regularly
- Very Often

Q2

Q3 – What makes an overlanding experience successful?
- Finding unique places to stay
- Getting out an enjoying nature

Q4 – Tell me about your favourite experience. What do you look forward to the most? What makes you want to go overlanding?
- Escaping crowds of people, and enjoying nature
- Overlanding in Utah. Exploring backroads of five national parks in the Midwest. The views and knowing that only a small % of people will see the things you are seeing in their lives makes the experience extra special
- The natural beauty of my surroundings
- Sleeping by waterfalls/ lakes, and going off roading

Q5 – Can you share any specific routes or trails that you've enjoyed?
- No because I enjoy getting lost in the process. Some of the best spots have been "mistakes"
- Trepassey and Cape Breton
- Anywhere my vehicle can take me
- Mersey

Q6 – What is one of your favourite overlanding destinations to go to in Nova Scotia?
- The next new one I haven't been to yet
- Cape Chidley
- South Shore or anywhere on the coastline
- Cape Breton

Q7 – What are some challenges you've encountered during overlanding trips?
- Getting lost, weather, not finding a good spot, broken/lost gear, no way to cook, no source of water
- Not packing enough food
- Access to great spots
- Trails are either super hard and technical when most vehicles can't do them or they're very busy like fire roads

Q8 – Reflect on challenges you've faced. How did you overcome them?
- Enjoying the adventure and not being concerned about the "schedule" or "destination"
- All about preparation and making sure you have everything
- Just make do

Q9 – Do you have any concerns related to the impact of overlanding on the environment, and do you have any suggestions for mitigating these concerns?
- Yes, but if done responsibly the issues are minimal. Basic level skill/ experience helps
- The overlanding community appreciates the land more (follow pack in pack out)
- Wish people would clean up after themselves
- Be as long as you leave places as they were if not better when you go there

Q10 – What recommendations do you have to elevate the overlanding experience, making it more sustainable and enjoyable?
- Good gear is worth the $ and its better to buy the right thing at the start than spending more money buying cheaper products. Good tent and sleeping bag will go a long way towards a good start
- Bigger communities/ investment from the government for better trails/ routes
- Open provincial and federal parks year round
- Clean up camp sites as best as possible and have fun

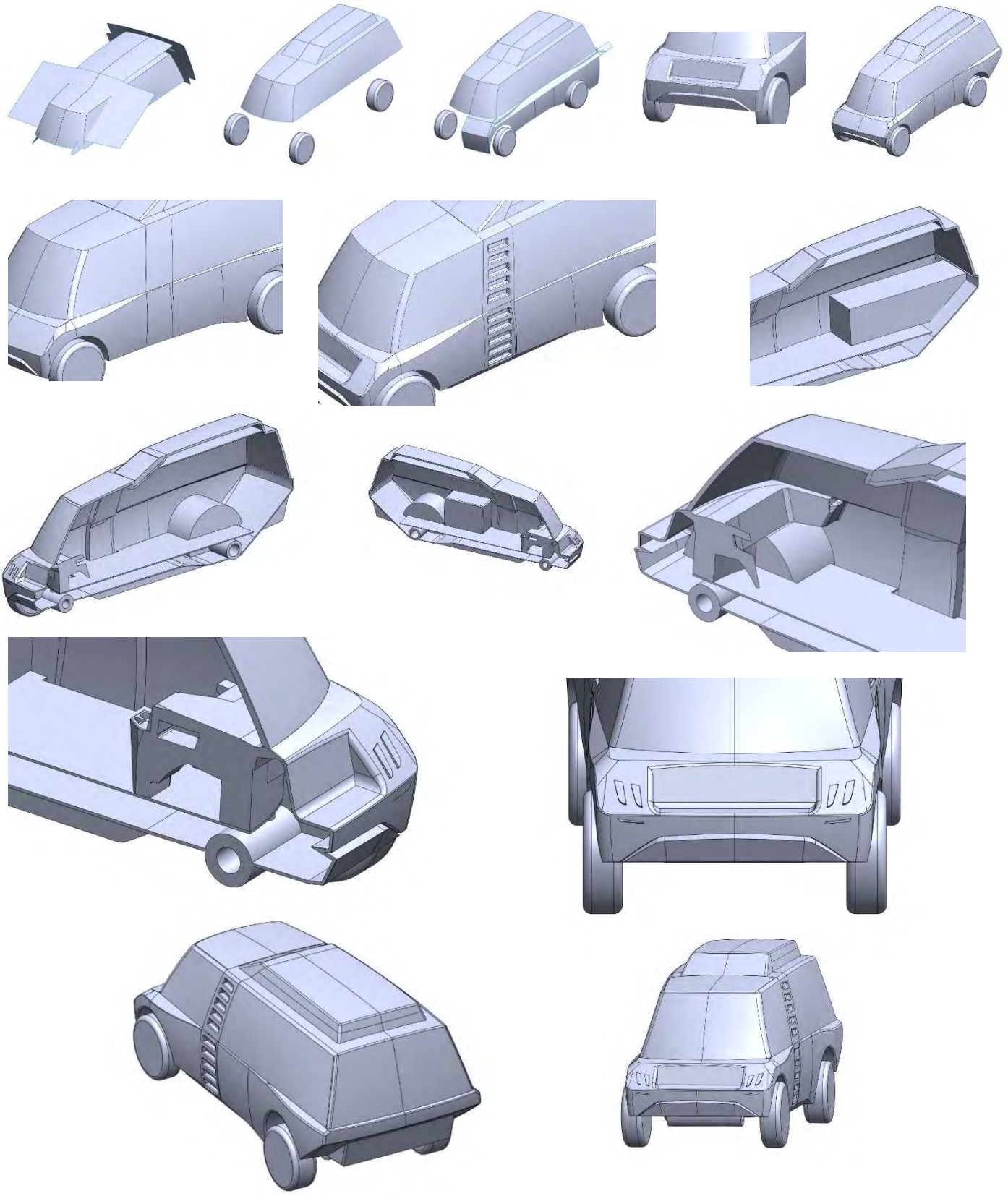
Q11 – What features do you believe are essential in an off-road vehicle that is used for overlanding?
- 2WD is good. But 4WD will get you farther, but it can also get you stuck if you don't know what you are doing
- 4WD and locking differentials
- Recovery and safety gear
- Roof top tent makes it very easy to set up camp

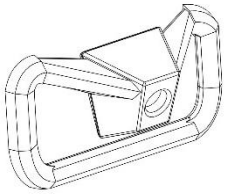
Q12 – Are there any changes/ improvements you'd like to see made in the future of overlanding?
- More cooperative on private land, less gates
- More participants in Nova Scotia
- More awareness, tips, coffee meetups, and more trails

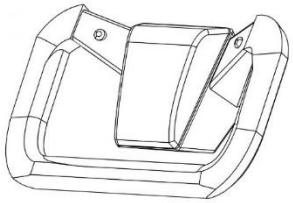
Q13 – Are there any local communities, forums, or resources that have been particularly helpful to you, and how have they contributed to your overlanding experiences?
- I haven't looked
- Nova Scotia Overlanding on Facebook
- Facebook groups and YouTube
- No

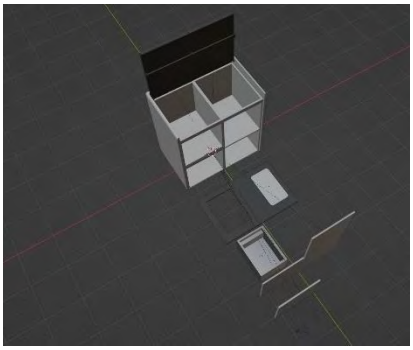
Q14 – Is there anything else you would like to add, whether it is a unique perspective,..... or recommendations for future research related to sustainable overlanding?
- No
- No
- N/A

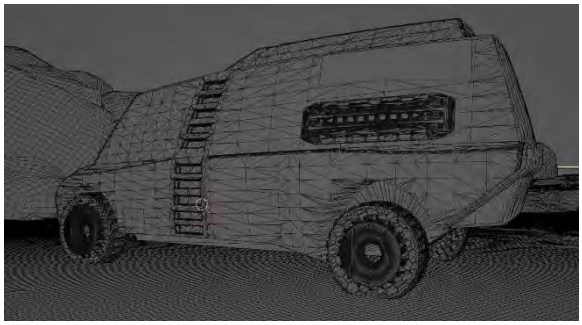
Appendix E: CAD Development

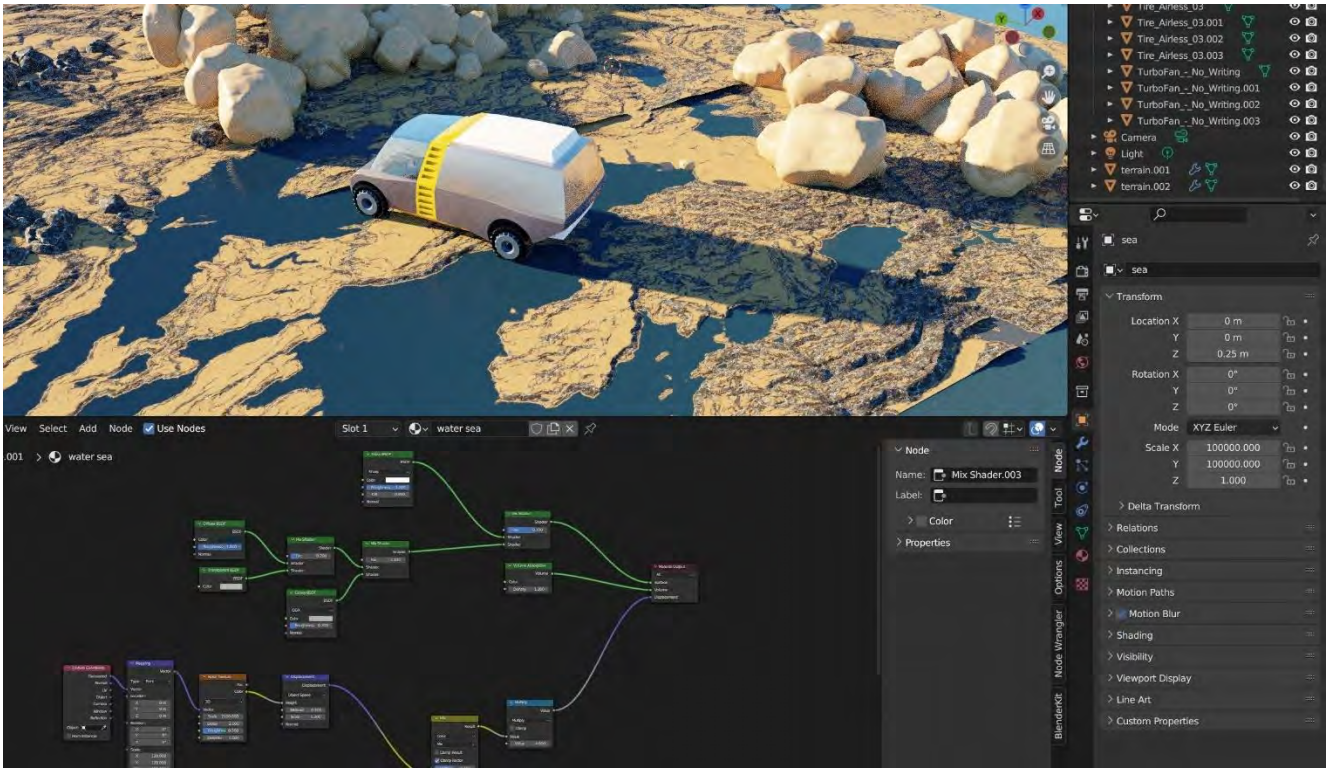








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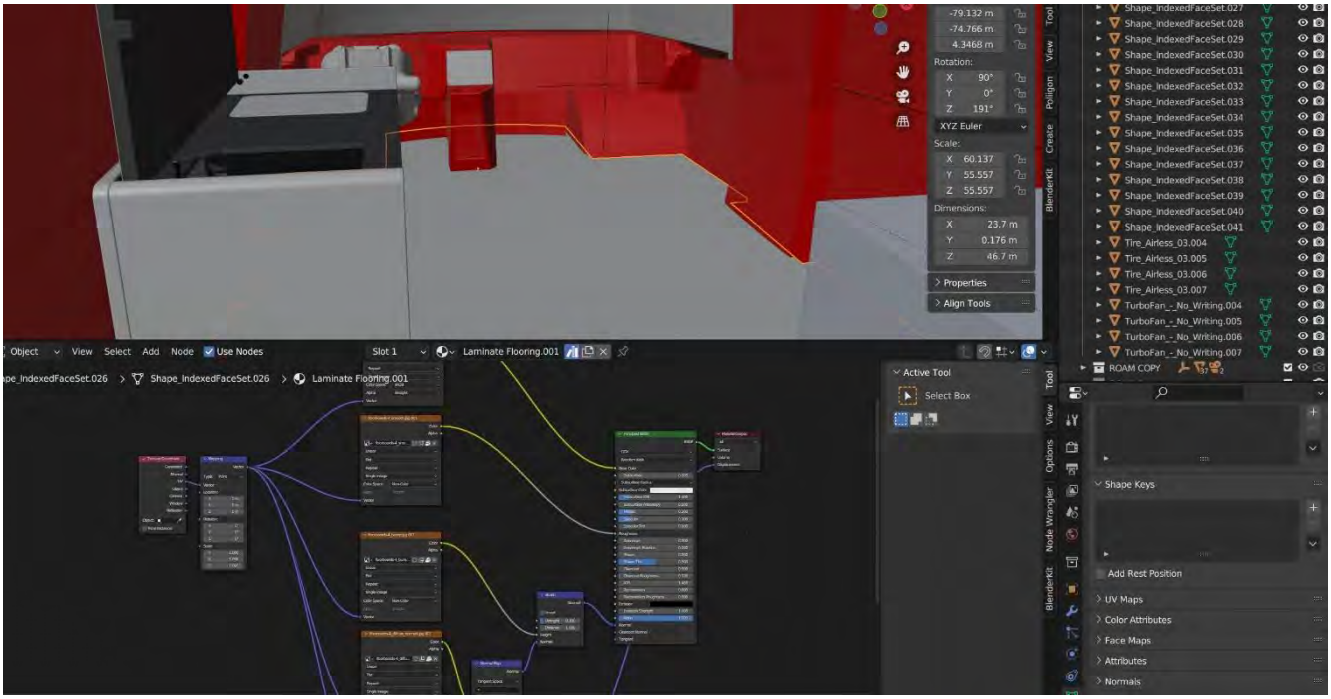
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Y 0.176 m
Z 46.7 m
Properties
Align Tools
Object View Select Add Node Use Nodes
Slot 1
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Shape_IndexedFaceSet.026
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Active Tool
Select Box
Shape Keys
Add Rest Position
UV Maps
Color Attributes
Face Maps
Attributes
Normals

Appendix F: Physical Model

Appendix J: Approvals and Plans

PANEL ON RESEARCH ETHICS
Navigating the ethics of human research

TCPS 2: CORE 2022

Certificate of Completion

This document certifies that

Isaac Kerr

successfully completed the Course on Research Ethics based on the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2: CORE 2022)

Certificate # 0000962480 **16 September, 2023**

THESIS TOPIC APPROVAL

Bachelor of Industrial Design / FALL 2023

Student Name:	Isaac Kerr
Topic Title:	How might we increase sustainability in off-road ecotourism in Nova Scotia?

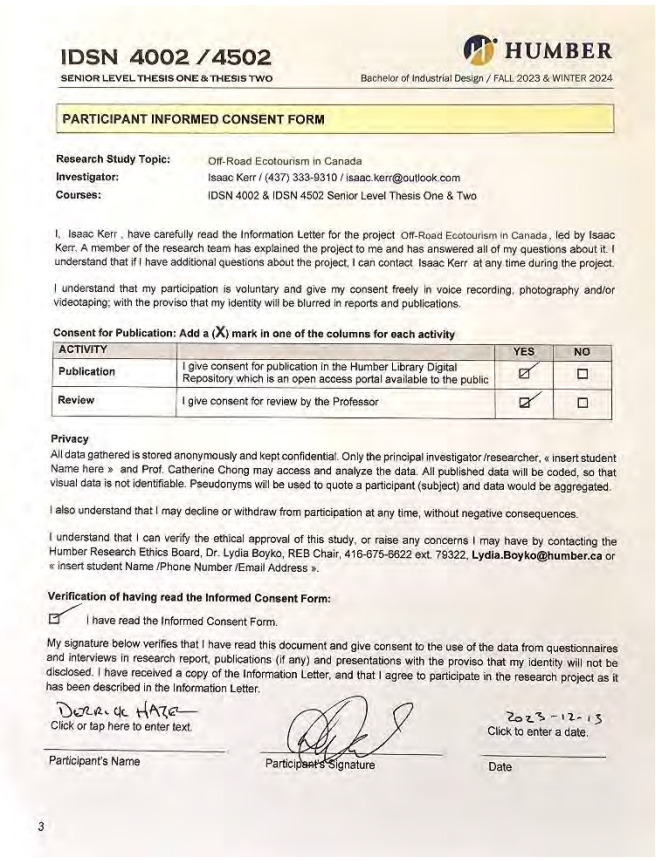
TOPIC DESCRIPTIVE SUMMARY (PRELIMINARY ABSTRACT)

This research confronts the challenge of mitigating ecological degradation stemming from off-road ecotourism in Nova Scotia. This overarching issue not only imperils the region's fragile ecosystems but also jeopardizes the long-term viability of a tourism industry central to Nova Scotia's economy. At its core, the problem intertwines environmental preservation, economic stability, and the safeguarding of Nova Scotia's distinctive natural heritage. To address this challenge, the research promotes a comprehensive design approach that combines various fields, such as tourism management. This approach primarily centers on the development of an environmentally friendly off-road experience aligned with ecotourism principles. This initiative aligns with the broader goal of promoting responsible tourism, conserving biodiversity, and increasing awareness about the importance of conservation. The research plan entails collecting data through surveys and interviews with experts. Both quantitative and qualitative research methods will be employed to gain a deep understanding of this multifaceted issue. Looking forward, the findings of this study will offer valuable insights into the effectiveness of sustainable off-road ecotourism practices. The assessment of specific design solutions and their consequences will play a pivotal role in guiding Nova Scotia toward an environmentally conscious future.

Student Signature(s):	
Date:	10/ 10/ 2023

Instructor Signature(s):	
Date:	12 October 2023

Appendix K: Advisor Meetings & Agreement Forms



IDSN 4002 /4502
SENIOR LEVEL THESIS ONE & THESIS TWO

HUMBER
Bachelor of Industrial Design / FALL 2023 & WINTER 2024

PARTICIPANT INFORMED CONSENT FORM

Research Study Topic: Off-Road Ecotourism in Canada
Investigator: Isaac Kerr / (437) 333-9310 / isaac.kerr@outlook.com
Courses: IDSN 4002 & IDSN 4502 Senior Level Thesis One & Two

I, Isaac Kerr , have carefully read the Information Letter for the project Off-Road Ecotourism in Canada , led by Isaac Kerr. A member of the research team has explained the project to me and has answered all of my questions about it. I understand that if I have additional questions about the project, I can contact Isaac Kerr at any time during the project.

I understand that my participation is voluntary and give my consent freely in voice recording, photography and/or videotaping; with the proviso that my identity will be blurred in reports and publications.

Consent for Publication: Add a (X) mark in one of the columns for each activity

ACTIVITY		YES	NO
Publication	I give consent for publication in the Humber Library Digital Repository which is an open access portal available to the public	☑	☐
Review	I give consent for review by the Professor	☑	☐

Privacy
All data gathered is stored anonymously and kept confidential. Only the principal investigator /researcher, « insert student Name here » and Prof. Catherine Chong may access and analyze the data. All published data will be coded, so that visual data is not identifiable. Pseudonyms will be used to quote a participant (subject) and data would be aggregated.

I also understand that I may decline or withdraw from participation at any time, without negative consequences.

I 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 « insert student Name /Phone Number /Email Address ».

Verification of having read the Informed Consent Form:

☑ I have read the Informed Consent Form.

My signature below verifies that I have read this document and give consent to the use of the data from questionnaires and interviews in research report, publications (if any) and presentations with the proviso that my identity will not be disclosed. I have received a copy of the Information Letter, and that I agree to participate in the research project as it has been described in the Information Letter.

Derrick Hazel — Click or tap here to enter text. (Participant's Name)
(Participant's Signature)
2023-12-13 — Click to enter a date. (Date)

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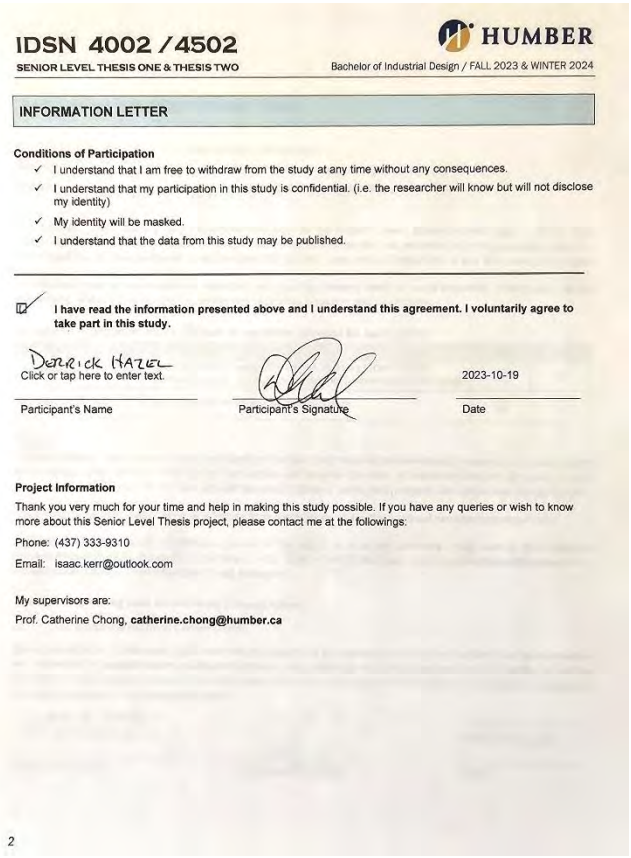

IDSN 4002 /4502
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INFORMATION LETTER

Conditions of Participation

- ✓ I understand that I am free to withdraw from the study at any time without any consequences.
- ✓ I understand that my participation in this study is confidential. (i.e. the researcher will know but will not disclose my identity)
- ✓ My identity will be masked.
- ✓ I understand that the data from this study may be published.

☑ **I have read the information presented above and I understand this agreement. I voluntarily agree to take part in this study.**

Derrick Hazel — Click or tap here to enter text. (Participant's Name)
(Participant's Signature)
2023-10-19 (Date)

Project Information

Thank you very much for your time and help in making this study possible. If you have any queries or wish to know more about this Senior Level Thesis project, please contact me at the followings:

Phone: (437) 333-9310

Email: isaac.kerr@outlook.com

My supervisors are:

Prof. Catherine Chong, **catherine.chong@humber.ca**

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