

Design Report

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Vertepac

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Chapter 1 - Problem

Introduction and background

There is a need for photography carrying systems which can be made for long-term comfort, high flexibility and low weight with accessible pockets directed at adventure and outdoor photographers. Vertepac's vision is to shape technology around your body to a level where it becomes an extension of yourself. They want to develop carrying systems that defy gravity, enhance performance and provide users more flexibility. They now offer a carrying system to dedicated hikers, but they want to extend and enhance their technology to appeal to a wider audience. They are targeting consumers who carry heavy loads and require a carrying system that transfers the weight from their shoulders to their hips while protecting their equipment and allowing them to move freely.

Problem statement

Photographers, both avid and professional, have very different gear needs and often transport heavy and fragile equipment on a daily basis to different locations, which can cause stress and discomfort on the body overtime. There is a market gap for a functional, versatile, everyday-use, camera-transport-oriented carrying system design that makes a load of 5 kilos (or more) easy to carry through specialized materials and technology that can be adjusted to diverse photographer needs and uses.

Design challenge

Design a bag that meets the needs of the target audience as a versatile, flexible bag that can be worn comfortably for long periods of time by various photographers while allowing simple and rapid access to gear and providing protection using user-centred research, ideation, and prototyping.

To have recognizable, clear unique selling factors and distinct advantages over competing backpacks on the market. Prototypes must be tested with target users to gain meaningful feedback on whether it is satisfying their needs, so they can be shown to the client and launched into the market with the lowest risk of failure.

Target group/market

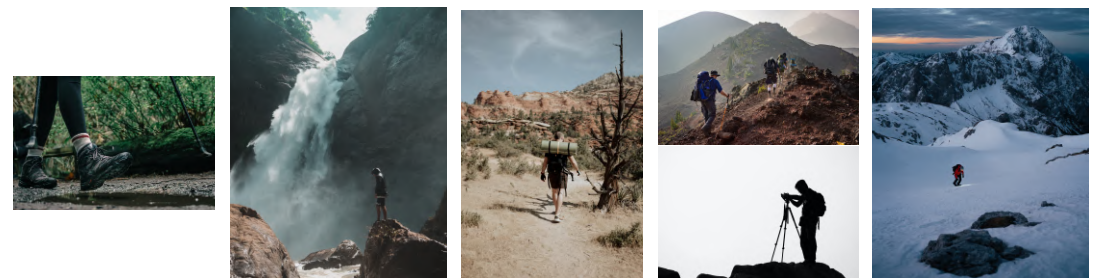
Male, adventurous, active upper-middle class avid or professional photographers of 18-54 year old who need to transport 5kg or more photography and/or videography equipment on a regular basis in outdoor settings in today's day and age.

Client initial specification:

- Smartly store and protect
- Connect to Vertepac
- Base characteristics of Vertepac must be present
- Keep human anatomy in the centre. Must be an extension of the user
- Lightweight
- Cost efficient
- Comfortable
- Silent
- Free + mobile
- Smart materials

Situation

The context where the carrying system may be used can be dusty, rainy, rocky, muddy, hot, humid and cold. These conditions must be kept in mind when designing and testing solutions.



Chapter 1 - Problem

Requirements

These requirements were made from research on market, competitors, the needs of the target group and situation where the product will be used.

D/V/F	Criteria	Requirement	Specification	Hard/Soft	Reference
Desirability (User)	User experience	Reduce the stress on the user's back. Comfortable and usable for various lengths of usage	Must not take away from the user's energy or productivity or capabilities over time, not stress inducing	Soft	Client value
			The bag should be able to be put on/taken off in less than 2 steps and without significant/uncomfortable strain	Hard	Interview, client, observation
			Mobile, flexible, fits well to the user and efficient to use	Soft	Interview, Client
			Back plate must allow airflow and heat dissipation	Soft	Questionnaire, client
			The backpack should have a solid base to rest upright	Soft	Interview
			Backplate must be an ergonomic shape that covers a large area	Soft	Client questionnaire
	Ease of use, intuition of use	Compartment placement must be easy-to-reach.	Must be able to retrieve /store internal items from compartments in less than 4 steps.	Hard	Questionnaire
			Zippers and external items fixtures must be in easy to reach locations able to be retrieved/ stored in in less than 2 steps.	Hard	Questionnaire
		Adjustability/ versatility/ fit the user well	Must be able to customise the interior compartments and dividers for different loadouts to meet multiple photographer type's needs for a wide variety of activities	Hard	Interview, questionnaire, client values
	Aesthetic (color + design)	The design's shape or form does not clash with the needs of the user	The appearance of the carrying system should not clash with the appearance of nature and surroundings	Soft	Questionnaire

Feasibility (Technological)	Strength/structure	Shoulder straps should be able to hold all the bag weight on a single strap	Thick cushion straps using a thick (more than 10mm) and large surface area (more than 15mm)	Hard	Interview
	Materials	The design should use recycled materials, and have any parts that will need to be replaced to be recyclable	Use easy to clean materials	Soft	Interview
	Secure and protect camera gear	Durability	External materials must be waterproof, lightweight, abrasion resistant and insulating like nylon and silicon so the bag should be able to withstand environmental conditions of rain, dust, snow, heat and cold.	Hard	Questionnaires
			Internal battery compartment must use fireproof materials in case of fire	Hard	Interview
		Adjustable for different camera gear sizes	Consider a variety of camera gear sizes including lenses, camera bodies, sd cards, drone and batteries in adjustable compartments	Hard	Interview, questionnaire
		Must have detachable components	Detachable items (wheels, hip belt, rain cover, internal dividers) should be able to be taken off/put on in less than 2 steps using gloves	Hard	Interview
	Size + weight measurements	Users should not hold more than 15% of their body weight in a backpack	Bag must not exceed 8.4kg (10% of average adult male weight)	Hard	Desktop research
		Balance and weight composition.	Compartments for heavier items (batteries + lenses) near the bottom for a lower center of gravity or near the user	Hard	Interview
		Meet aeroplane carry-on requirements	Meet size requirement of 55X35X25cm(KLM)	Hard	Desktop research
			Meet carry-on weight requirements of 12kg (KLM)	Hard	Desktop research

Viability (Business)			The carrying system can be shared and used by different sized users of the 5th to 95th percentile of 18-54 yr olds	Average sized male hand size of 15 X 30cm should be able to access internal spaces	Hard	Desktop research
		Capacity	Internal compartments must be versatile and adjustable to be oval or rectangular for different camera gear shapes and sizes to accommodate different equipment	Accommodate 2 camera bodies, 2 spare lenses, 8 batteries, 1 SD card.	Hard	Interview, questionnaire
	Cost	Price	Price \$359 or less		Hard	Client
		Manufacturing	Minimize energy consumption using low-energy manufacturing processes which use low requisite temperatures and pressures of processes.	To minimise waste by 3D printing and using other low/no waste manufacturing techniques	Soft	Desktop (trend) research
			Production type	To be able to manufacture using batch production. Carrying systems will be manufactured over a period of time, rather than all at once in bulk	Hard	Client
		Life cycle	The chemicals and processes used should minimise harm for the environment and nature during its life cycle		Soft	Desktop (trend) research

Chapter 1 - Problem

Personas

These personas were used to generate and select ideas in the initial ideation phases. I designed and considered for their needs and the personas were used to evaluate whether the ideas achieved the goal of targeting their needs. It will also be used to evaluate my final concepts.

Christopher Smith



"Always be with the best."

Age: 64
Work: Drone Photographer,
Eagle Wildlife photographer
Family: Married
Location: British Columbia,
Canada

Passionate Observant Honest Kind

Goals

- To show the nature and beauty around us.
- To learn and use slow-motion photography.
- To become the best.

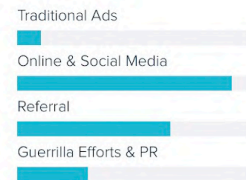
Frustrations

- Carry-on luggage is costly.
- Carrying heavy bags.
- Batteries going cold.

Bio

1.96m tall German-Canadian photographer, forum speaker and astronomer. Eagles are another favourite photography subject of his, who shoots mainly with a Nikon D5 camera body and a 800f/5.6E telephoto lens. He uses a variety of equipment including video cameras, slow-motion cameras and drones to conduct his work.

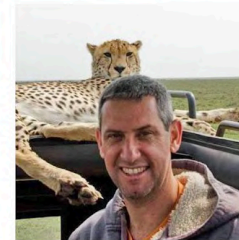
Preferred Channels



Personality



Nooray Abrams



"Know your subject to capture it to its fullest."

Age: 45
Work: Wildlife photographer,
philanthropist and safari guide
Family: Married, one son
Location: New York, US

Responsible Generosity Courageous
Integrity

Goals

- To learn how to take architectural photography.
- Raise money for conservation efforts.
- Photographing wild dogs.

Frustrations

- No laptop space in camera backpack.
- Airline weight restrictions.
- Problems with the available solutions.

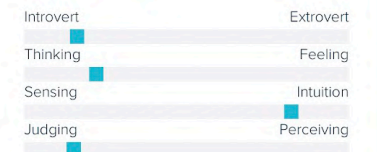
Bio

Nooray has loved animals since childhood. Growing up in Palestine, he dreamed of becoming a wildlife veterinarian. He studied veterinary medicine before moving to New York City where he mostly treats cats and dogs. He is a wildlife photographer and an avid traveler and hiker.

Preferred Channels



Personality

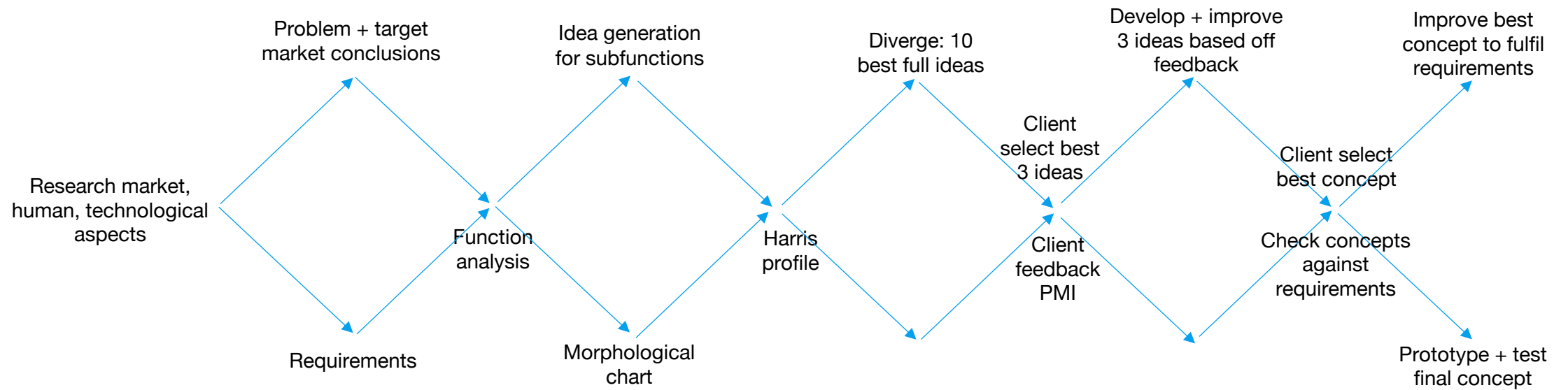


Chapter 1 - Problem

Design process + approach



Iterative process



Chapter 1 - Problem

Gantt chart project planning

This is my project time plan to estimate how long tasks will take and ensure my project stays on-track and meets milestones on time.

Task	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15	Week 16	Week 17	Week 18	Week 19
Client meeting																			
User interviews																			
Trend + market research																			
Identification of problem																			
Brief and analysis of problem																			
Specification + LoR																			
Research report																			
Initial ideas																			
Development of ideas																			
Selection of ideas																			
Analysis of ideas																			
Development into concepts																			
Lo-fi prototyping + mock-ups																			
Testing																			
Improved prototype																			
Finalising design + documentation																			
Final Presentation Week																			

Chapter 1 - Problem

Weekly planning (Week 1-12)

This planning was updated throughout the project to ensure I knew what tasks needed to be completed for the following week.

Key:	
Meeting:	
Complete:	
Incomplete:	

Weekly Project Plan																			
Day:	Date:	Main task:	Other tasks:																
Week 1	Monday	08/02	Lockie Ross Interview																
	Tuesday	09/02	1st iteration DB																
	Wednesday	10/02	Senko Meeting																
	Thursday	11/02	Yaron Schmid Interview																
	Friday	12/02	Dr Christian Sasse Interview																
	Saturday	13/02																	
	Sunday	14/02																	
Week 2	Monday	15/02	Interview summary																
	Tuesday	16/02																	
	Wednesday	17/02	Senko Meeting																
	Thursday	18/02	Gantt chart																
	Friday	19/02	Fill out planning for next weeks																
	Saturday	20/02																	
	Sunday	21/02																	
Week 3	Monday	22/02	Senko Meeting																
	Tuesday	23/02																	
	Wednesday	24/02	Competitor product analysis																
	Thursday	25/02	Decide on research topics + make research question																
	Friday	26/02	Start LoR																
	Saturday	27/02	Join Photographer webinar																
	Sunday	28/02																	
Week 4	Monday	01/03	Make 2 personas																
	Tuesday	02/03	Improve research question																
	Wednesday	03/03	DESTEP analysis																
	Thursday	04/03	Update design brief																
	Friday	05/03	Brand trend behaviours																
	Saturday	06/03																	
	Sunday	07/03																	
Week 5	Monday	08/03	SWOT Analysis																
	Tuesday	09/03	Competition map																
	Wednesday	10/03	Stakeholder analysis																
	Thursday	11/03	Research bags/products for back problems																
	Friday	12/03																	
	Saturday	13/03																	
	Sunday	14/03																	
Week 6	Monday	15/03	User observation at store																
	Tuesday	16/03	Create moodboard																
	Wednesday	17/03	Triangulation of research to find problem sweet spot																
	Thursday	18/03	Venn diagram of user sweet spot																
	Friday	19/03	Update requirements																
	Saturday	20/03																	
	Sunday	21/03																	
Week 7	Monday	22/03	First diverging																
	Tuesday	23/03	Co-diverging session using Miro board																
	Wednesday	24/03	Start report																
	Thursday	25/03	Make questionnaire																
	Friday	26/03	Questionnaire summary																
	Saturday	27/03																	
	Sunday	28/03																	
Week 8	Monday	29/03	User observation at camera store																
	Tuesday	30/03	Report introduction																
	Wednesday	31/03	Report methodology section																
	Thursday	01/04	Report results + discussion section																
	Friday	02/04	Report conclusion																
	Saturday	03/04																	
	Sunday	04/04																	
Week 9	Monday	05/04	Report references, appendix, abstract																
	Tuesday	06/04	Customer values analysis																
	Wednesday	07/04	Client values table																
	Thursday	08/04	Hand-in midterm documentation																
	Friday	09/04																	
	Saturday	10/04																	
	Sunday	11/04																	
Week 10	Monday	12/04	MIDTERM																
	Tuesday	13/04	H2 questions diverging on photographer type and moodboard																
	Wednesday	14/04	Conclude requirements from all research methods																
	Thursday	15/04	Morphological chart																
	Friday	16/04	Function analysis																
	Saturday	17/04																	
	Sunday	18/04																	
Week 11	Monday	19/04	Place requirements into D,V,F categories																
	Tuesday	20/04	Create criteria from LoR																
	Wednesday	21/04	Put subfunction ideation in harris profile																
	Thursday	22/04	Use harris profile to find best subfunction ideas																
	Friday	23/04	Combine subfunction ideas to make 10 designs																
	Saturday	24/04																	
	Sunday	25/04																	
Week 12	Monday	26/04	PMI feedback from client																
	Tuesday	27/04	Client chosen 3 concepts																
	Wednesday	28/04																	
	Thursday	29/04																	
	Friday	30/04																	
	Saturday	01/05																	
	Sunday	02/05																	

Chapter 1 - Problem

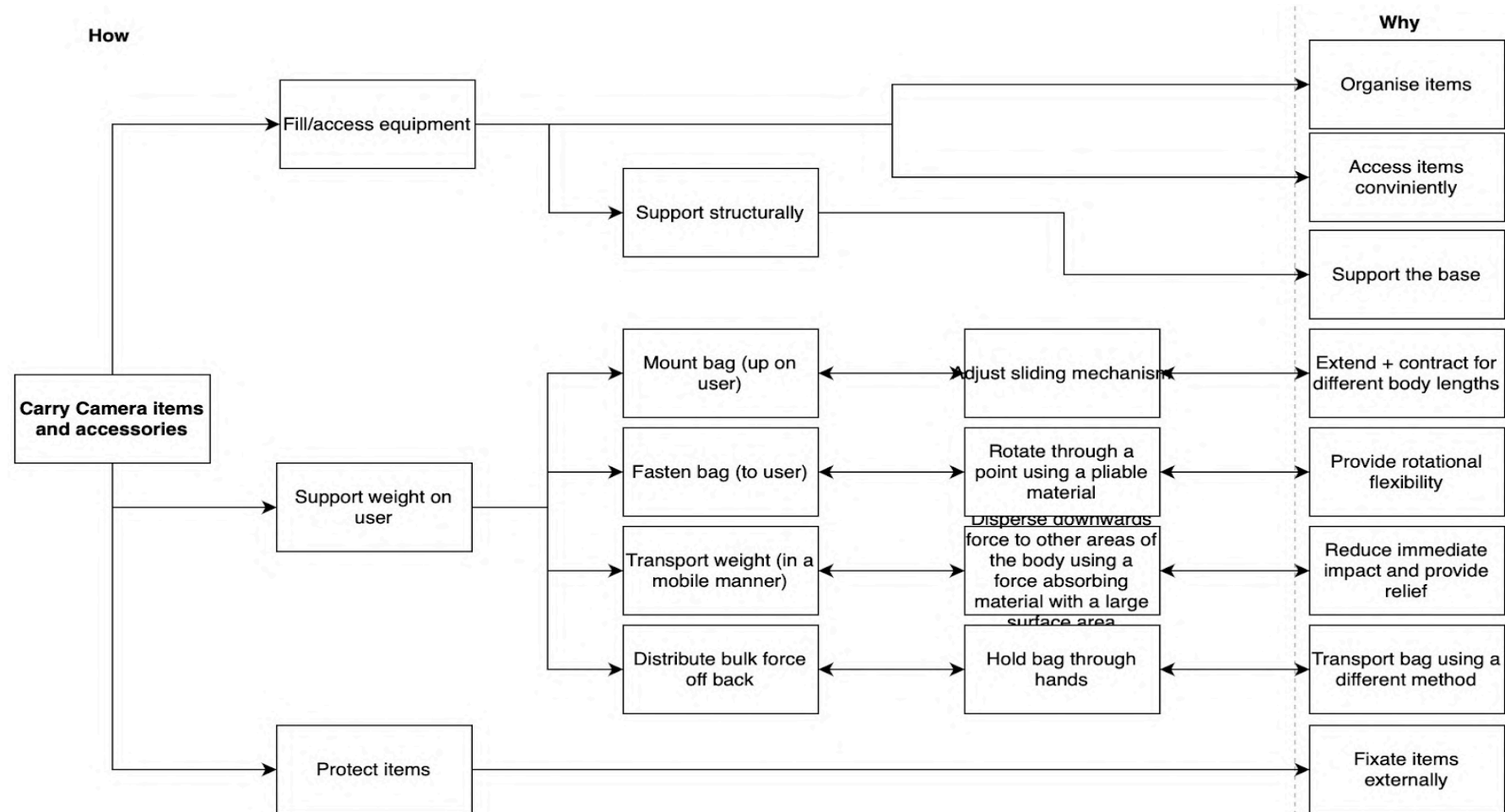
Weekly planning (Week 13-20)

Week 13	Monday	03/05	1.5 (research report)		
	Tuesday	04/05	3.3 (fuzzy context flexibility, decision making process, evaluate)		
	Wednesday	05/05	4.3 (consistent style according to target group + personal style.)		
	Thursday	06/05	4.1 (Documenting in convincing manner)		
	Friday	07/05			
	Saturday	08/05			
	Sunday	09/05			
Week 14	Monday	10/05	2.3 (linking H,M,T,C values in design process (design report))		
	Tuesday	11/05	5.1 (role + impact on design process + society reflection)		
	Wednesday	12/05	12:00 Hand-in Go/ No-Go		
	Thursday	13/05			
	Friday	14/05			
	Saturday	15/05			
	Sunday	16/05			
Week 15	Monday	17/05	Sketch 3 improved concepts based off client feedback		
	Tuesday	18/05	Concept evaluation using weighted objectives		
	Wednesday	19/05			
	Thursday	20/05	GO/ NO-GO		
	Friday	21/05	Testing plan		
	Saturday	22/05			
	Sunday	23/05			
Week 16	Monday	24/05	Test and improve prototypes		
	Tuesday	25/05	Prototype front pack		
	Wednesday	26/05	Prototype vertepac spine		
	Thursday	27/05	Prototype backpack		
	Friday	28/05	Testing insights and reflection		
	Saturday	29/05			
	Sunday	30/05			
Week 17	Monday	31/05	Research anthropometric sizes of users using Dined TU delft		
	Tuesday	01/06	Technical drawing		
	Wednesday	02/06	Sketch final concept internals + externals		
	Thursday	03/06	User + context sketch, communicate how to use product		
	Friday	04/06	Reflection on success of project, reflection report		
	Saturday	05/06			
	Sunday	06/06			
Week 18	Monday	07/06	Sketch w/ material expression		
	Tuesday	08/06	Material + manufacturing choice reasoning		
	Wednesday	09/06	Cost estimation analysis		
	Thursday	10/06	Research report		
	Friday	11/06	Future modifications		
	Saturday	12/06	Design report		
	Sunday	13/06	Design brief		
Week 19	Monday	14/06	12:00 Hand-in Final documentation		
	Tuesday	15/06	Test with professional		
	Wednesday	16/06	Create presentation for final pitch		
	Thursday	17/06	Final presentation speech prep		
	Friday	18/06			
	Saturday	19/06			
	Sunday	20/06			
Week 20	Monday	21/06	Final presentation week		
	Tuesday	22/06			
	Wednesday	23/06			
	Thursday	24/06			
	Friday	25/06			

Chapter 1 - Problem

Function analysis

This function analysis was made to understand the problem and investigate the key purposes that the product has to achieve in order to be a successful product. It will be used in all stages of the design process to evaluate whether all functions have been met.



Chapter 2 - Process

Research: Market (Viability) and Technological (Feasibility)

A SWOT analysis is a business method that was used to investigate whether there were strengths and opportunities that could be used to Vertepac's advantage and also consider any weaknesses or threats that had to be known to be careful about.

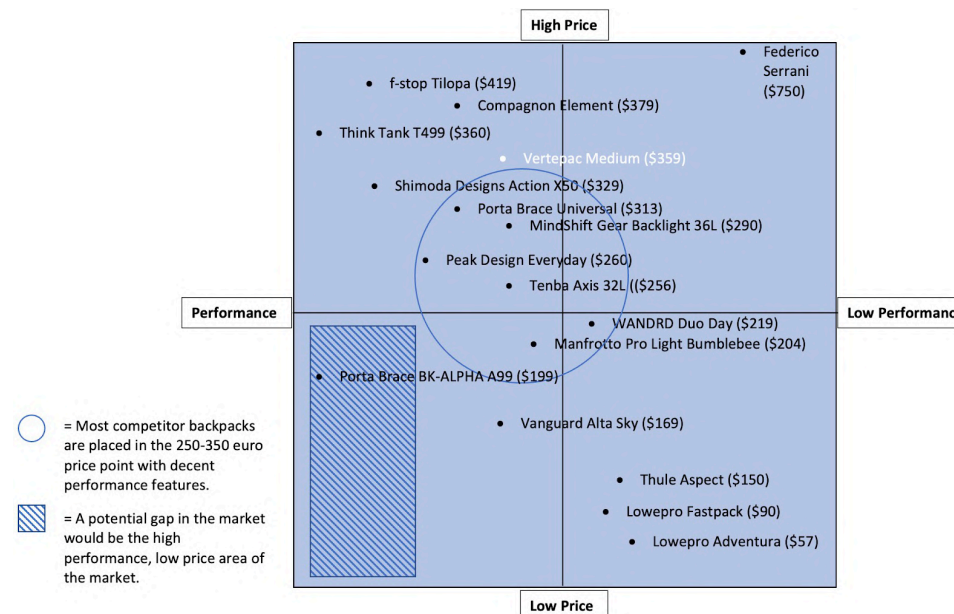
The competition map is a method to look into competitor products pricing, strengths and what makes them unique. It was also used to investigate any gaps in the market that could be targeted in order to have a successful implementation in the market.

The stakeholder analysis is used to evaluate all persons or organisations of interest to the product. This is to ensure that all stakeholders are considered to try and keep everyone happy, especially the stakeholders with a high interest and power.

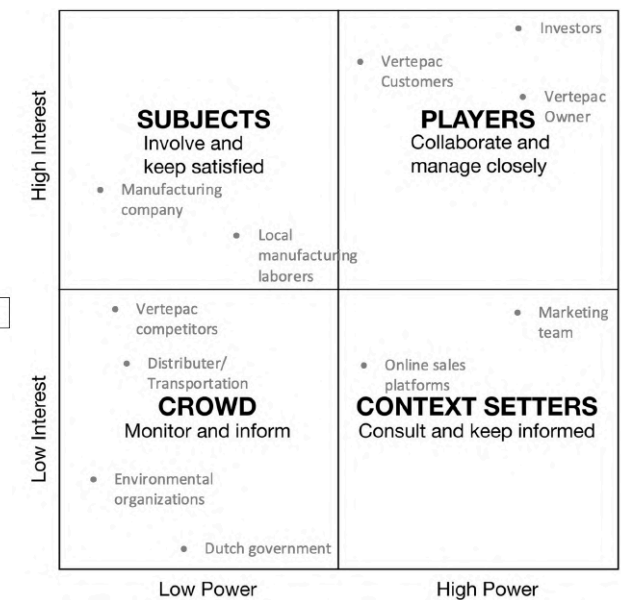
SWOT analysis



Competition map



Stakeholder analysis



Chapter 2 - Process

Research: Market (Viability) and Technological (Feasibility)

Product analysis

Affordable backpack

Manfrotto Pro Light Bumblebee 150



How this product may serve as inspiration for my designs:

-Rain protection is a cheap solution to waterproofing the bag. The laptop compartment can be an interesting feature that can interest target users who take laptops/tablets on their expeditions.

Suitcase

Think Tank T499 Airport Takeoff



How this product may serve as inspiration for my designs:

-The carry-on dimensions and retractable components can be useful for target market who travel frequently. Has opened my eyes to the possibility of using retractable components such as handles.

Slinger

Loweepro Adventura SH 160 II



How this product may serve as inspiration for my designs:

-The idea of the slinger + lightweight construction allowing for convenient retrieval. Suitable for shorter trips. The hard bottom would provide a solid, free-standing base.

High-end backpack

Porta Brace BK-ALPHA A99



How this product may serve as inspiration for my designs:

-Multifunctional and adjustable pouches and straps provides stability and allows for multiple items of different sizes to be stored. The high-quality + branded materials/components translate a higher price.

Chapter 2 - Process

Research: Human (Desirability)

The table listed below is a summary from analysing all the reviews of the current Vertepac system. The coloured table at the bottom displays their most desirable factors of the Vertepac.

Target audience review analysis

Vertepac and other carrying system reviews											
Review							Key words				
Vertepac											
"During the 700 miles Yukon river race, I have been using the Vertepac continuously to carry a load of 6 kg - a 4 liter hydration combo-blatner and some additional stuff. It allowed me to keep pushing much longer and take fewer breaks than I would have without it. So I was very happy to have it! I feel I could move my upper body so smoothly. Without feeling any restrictions, and pressure or pain on my back and shoulders."							"Continuously" - productivity, fatigue "Without feeling any restrictions" - not limiting, mobility "Allowed me" - freedom "Fewer breaks" - efficiency "So smoothly" - not limiting ability				
"I do a lot of long distance hiking, running and cycling in the UK. I decided to throw everything into the 18L bag as if I was doing the walk in winter. All my waterproofs, spear t-shirts/jackets, I even put in my big binoculars. I was so impressed that I could hardly notice that I was carrying the extra weight, and the extra weight didn't slow me down at all. I had no aches or pains in my shoulders or back."							"Throw everything" - spacious, confidence "Big binoculars" - ability to fit larger items "Hardly notice" - ease "Didn't slow me" - effectiveness "No aches" - relieving, soothing				
Factor	Review 1	Review 2	Review 3	Review 4	Review 5	Review 6	Review 7	Review 8	Review 9	Review 10	Quantity
Flexibility/mobility:											10
Weight/ fatigue:											7
Balance/composition:											4
Adjustability/versatility:											3
Room:											3
Reliability/confidence:											3
Fit:											3
Ease of use:											2

The Questionnaire was used to gather a lot of data on specific user problems in a short amount of time. The table listed below summarizes their top desired aspects of a carrying system.

Most desirable factors (Questionnaire)

Rate lack of back + shoulder strain in order of importance	Rate durability in order of importance	Rate capacity/size in order of importance	Rate waterproofing in order of importance	Rate aeroplane carry-on friendliness in order of importance	Rate number of pockets + compartment in order of importance
5	3	4	3	4	4
2	2	3	1	3	2
5	5	5	3	5	5
4	4	5	3	3	3
4	5	4	3	5	5
5	2	4	4	5	3
4	4	4	5	4	4
5	4	4	4	4	4
5	4	3	5	5	3
4	5	5	2	1	4
4	4	5	4	4	4
3	4	4	4	4	4
5	4	4	5	4	5
5	4	3	5	5	3
4	5	4	5	3	5
3	5	3	3	4	5
4	4	4	4	2	2
4	5	4	4	3	2
5	5	4	4	3	3
3	3	3	4	3	3
4	3	3	2	2	2
3	3	3	3	3	3
4	5	5	5	3	3
5	4	4	5	4	5
5	4	4	4	4	4
4	4	5	3	4	4
4.16	4	3.92	3.76	3.6	3.6
1	2	3	4	5	5

Chapter 2 - Process

Research: Human (Desirability)

A summary of the interviewees needs and wants was made and sorted by frequency of how often it was mentioned. Requirements were made from these needs and problems

Interview issues and needs

Issue	Frequency	Source	Possible Requirement
Only use waist belt for longer distances	YCL	Interview	The waist belt needs to be removable and be able to be stored in or on the bag.
Shoulder pain/uncomfortable straps	LYC	Interview	Shoulder straps need to have a large surface area with good (at least 1.5cm thick) cushioning.
Bag weight proportionality (i.e. heavier items on bottom + Bag pulls user back) / Balanced backpack (back and front balance)	LC	Interview	Compartments for heavier items (batteries + lenses) need to be placed at the bottom.
Not efficient to change lenses	YC	Interview	The backpack should have compartments on the belt and shoulder straps for items that need to be exchanged frequently (such as lenses and batteries) and can be retrieved easily and quickly.
Carry-on weight restrictions	YC	Interview	The backpack shall be less than 50X40X30cm and less than 8kg.
No bag wheels	YC	Interview	The bag shall include detachable wheels that can be reattached with less than 2 steps and with gloves.
Batteries get cold/ no insulation	LC	Interview	The backpack will use insulating materials that can keep in temperature for more than 30 minutes.
Contents of backpack move about	LC	Interview	The backpack should contain at least 8 securing methods for equipment and/or use cutouts.
Batteries + lenses are significant weight	CL	Interview	To hold batteries and lenses towards the bottom of the backpack or near the user

This client values table is based on quotes from Vertepac's website, company motto, profile and interviews with the client. Values were analysed and requirements were made from this.

Client values

Client Statement	Values	Requirement(s)
Full freedom to move for everyday pioneers.	<ul style="list-style-type: none"> Be honouring Support Encourage Be integrated Customer bonding 	Must not take away from the user's energy or productivity over time. To be comfortable to use daily and versatile for a wide variety of activities.
We improve personal mobility, creating smart, fit-for-purpose products that offer high-quality, great comfort and optimized performance.	<ul style="list-style-type: none"> To unite Move forward Reliability 	The carrying system should be a consistent unit, different versions for different customers should not exist. Should aim to be reliable. The carrying system should be as comfortable as possible.
The best way to predict the future is to create it.	<ul style="list-style-type: none"> Innovation Be devoted To nurture Kaizen 	Devotion to understanding their customers, trends, lots of research and development. Constantly looking to improve.
Effortless carrying, full freedom of movement.	<ul style="list-style-type: none"> Be awake Be devoted To unite 	Must be mobile and efficient to use. Carrying system should add to, not take away from, the user's capabilities. TO be convenient and not be stress inducing.

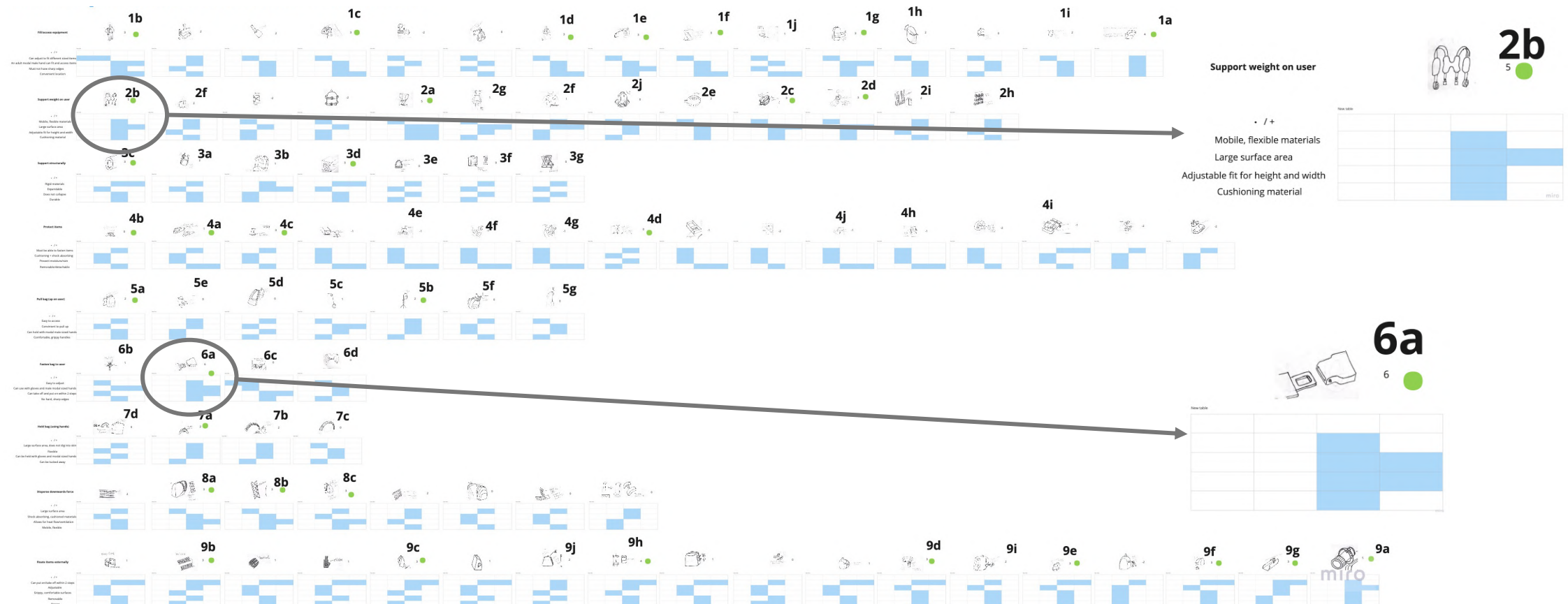
Based on the function analysis, H2 questions were used to diverge on possible solutions for each subfunction. In total, there were over 120 ideas sketched. These ideas will be put through a converging method to identify the best ideas for each subfunction, and then combined to develop the full designs.



Chapter 2 - Process

Design iteration: Subfunction sketches put into Harris profile

All the previous subfunction sketches needed to be put through a converging method to select the best ideas to be clustered and made into full ideas. Harris profile was a quick and visual way to evaluate ideas. I did this method with my client and mapped out what ideas would be combined. All the ideas with the same letters were combined, for example all the 'A' ideas.



Design 1

- Pull bag (top on user)

Design 2

- Custom bag to user

Design 3

- Hold bag (using hands)
- Pull bag (top on user)

Design 4

- Pull bag (top on user)
- Custom bag to user
- Hold bag (using hands)
- Ejector downwards force

Design 5

- Support structurally

Design 6

- Support structurally

Design 7

- Disperse downwards force
- Hold bag (using hands)

Design 8

- Hold bag (top on user)
- Support structurally
- Disperse downwards force

Design 9

- Disperse downwards force
- Pull bag (top on user)
- Support structurally
- Hold bag (using hands)

Design 10

- Pull bag (top on user)
- Support structurally
- Disperse downwards force
- Hold bag (using hands)

The sketches show various bag shapes, some with handles, straps, or internal structures. The labels describe how the bags are used or what forces they exert.

The subfunction sketches were combined to make 10 final ideas. The client was presented with these ideas and selected the final 3 he wished to be proceeded with. All ideas were given PMI feedback by the client to be used to improve and develop the ideas further.

16

Chapter 2 - Process

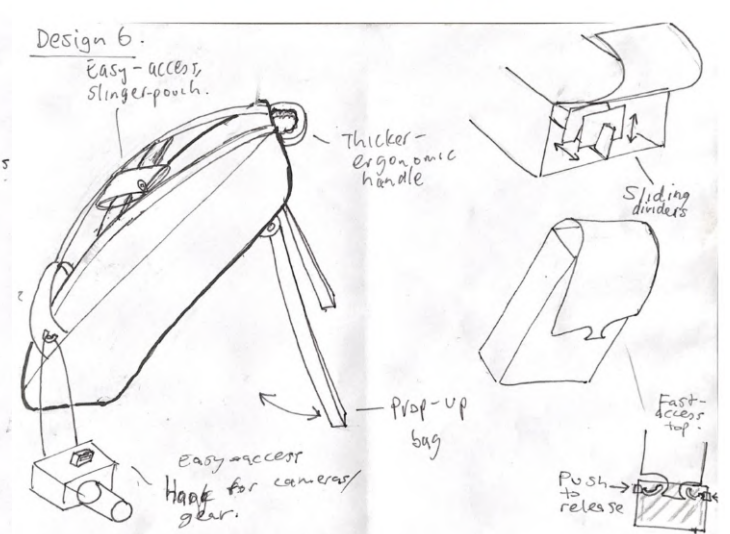
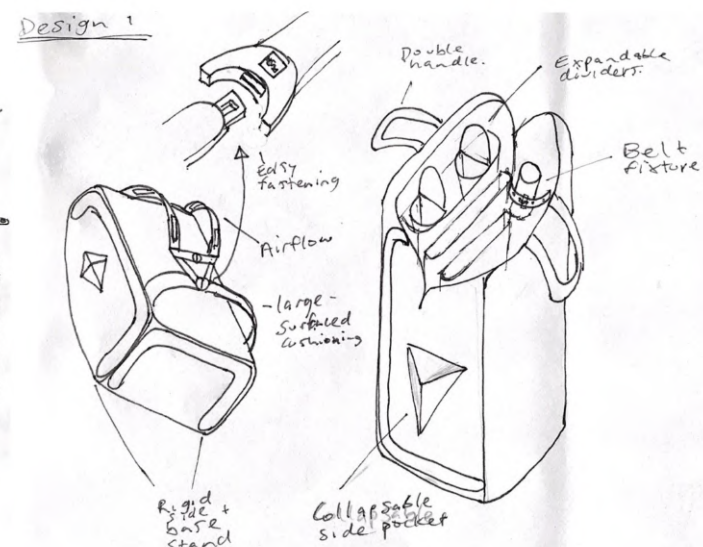
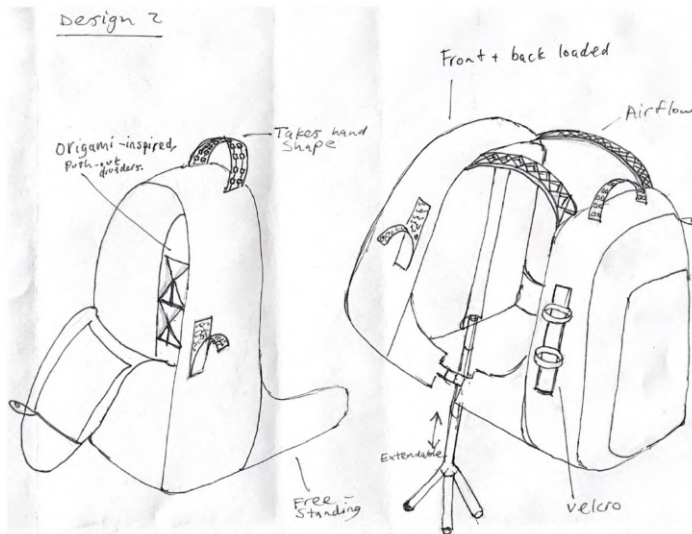
Final 3 concept characteristics

Client choice = ●

Design 3 ●

Design 4 ●

Design 6 ●



Client PMI feedback

Plus	Minus	Interesting
<ul style="list-style-type: none"> • Pull out compartments • Free-standing by hip • Shoulder strap with airflow 	<ul style="list-style-type: none"> • Adding weight = money • Base characteristics of Vertepac must be implemented • Keep human nature and anatomy in the center - think of it as an extension of yourself 	<ul style="list-style-type: none"> • Handle good for short distances • Possibility to add bag on chest

miro

Plus	Minus	Interesting
<ul style="list-style-type: none"> • Buckle works and is adjustable. • Protecting strong base 	<ul style="list-style-type: none"> • Straps dangle if shorter person is using • Can only access from top • Not lightweight • Not cost efficient, affordable 	<ul style="list-style-type: none"> • Elastic external compartment which can be flattened is interesting • Can position bag in multiple ways

miro

Plus	Minus	Interesting
<ul style="list-style-type: none"> • Smartly protect and store • Action pack • Silent • Freedom + mobility 	<ul style="list-style-type: none"> • Think about aeroplane-functional strong and light • Connect to Vertepac 	<ul style="list-style-type: none"> • Research aluminium bag with (german brand)

miro

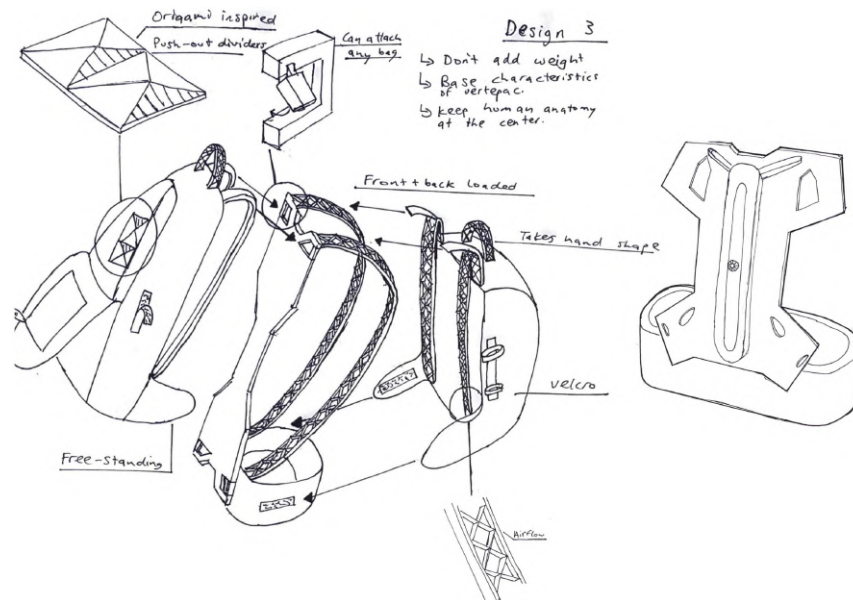
Chapter 2 - Process

Developed Final 3 concepts

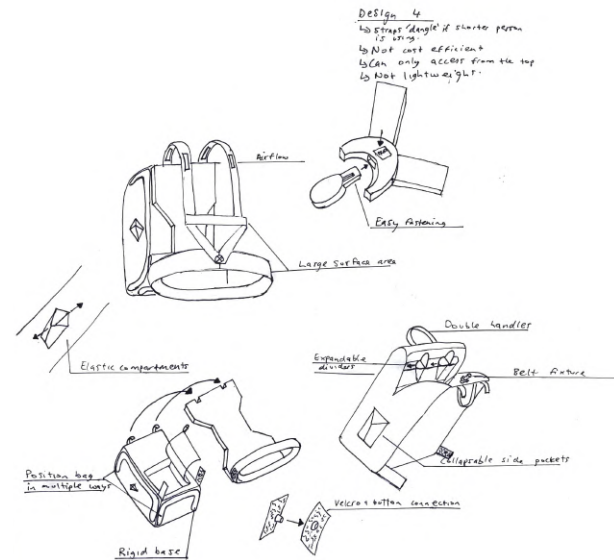
The three concepts were developed based on the PMI feedback that was received. The developed concepts were sketched out and shown to the client. Design 3 was selected to be prototyped and tested.

Client choice = ●

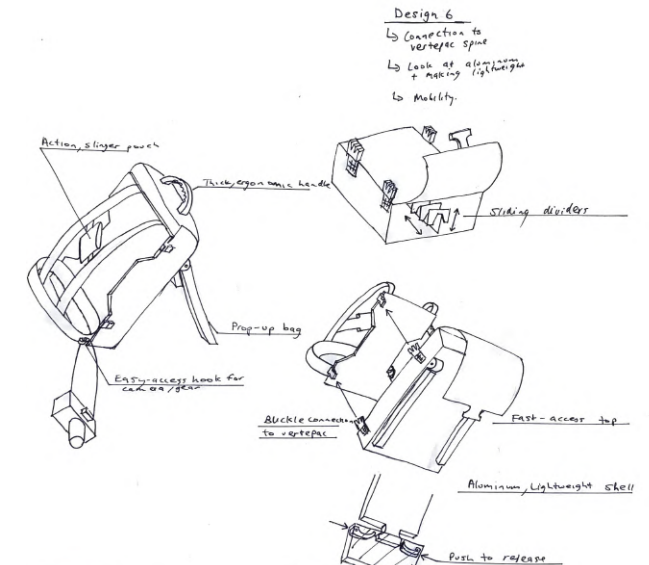
Design 3



Design 4



Design 6



Chapter 2 - Process

Testing plan:

A testing plan was made to identify what aspects needed to be evaluated and tried out. After that a Gantt chart was used to make sure that everyday was spent well as the workshop was only open for specific hours of the day and needed to be reserved in advance.

Test aspect	Insights hoped to gain	Material needed
Easy to reach locations	Best areas to place the external compartments	Camera, backpack.
Backpack paper scale model to test size and shape	To check if the size and shape of the backpack fits all the camera gear require as well as not affecting mobility and flexibility	300g paper, cardboard, gluegun, tape, scissors, ruler, pencil.
Action (front) pack paper scale model to test size and shape	To check if the size and shape of the action pack fits all the necessary equipment whilst not hindering mobility and flexibility	300g paper, cardboard, gluegun, tape, scissors, ruler, pencil.
How backpack and action pack connects to Vertepac backplate	A universal and convinient method of connecting backpacks to the backplate	Buckles, clips, , velcro, gluegun, tape, old bag straps, 300g paper.
Backpack + front pack securing and cushioning of items	Find ways of protecting gear so it does not get damaged through vibration, shock or external environmental effects	Socks, velcro, 300g paper, gluegun, tape, cardboard, scale lens, scale camera body, scale batteries.
Organise/customising gear loadouts, gear loading and retrieval, detaching of compartments/dividers	To check that gear can be retrieved and stored with ease. To check that different loadouts can be customised. The easiest method of detaching dividers and compartments	Socks, velcro, 300g paper, gluegun, tape, cardboard, scale lens, scale camera body, scale batteries.
Physically testing both the final backpack and front pack prototypes with camera gear	Looking for any discomfort spots and any areas that decreased mobility when moving and when getting gear out	Camera, elevated surface, scale lens, scale camera body, scale batteries.

Test aspect	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Easy to reach locations							
Backpack paper scale model for size and shape testing							
How backpack connects to backplate							
Action pack paper scale model for size and shape testing							
How front pack connects to the rest of the carrying system							
(Backpack) Securing and cushioning of items in compartments and dividers							
(Front pack) Securing and cushioning of items in compartments and dividers							
Organisation and customisation of backpack interior							
Physically testing the front and backpack							

Chapter 2 - Process

Testing:

Insights:



Easy to reach locations

- The only reachable areas with the bag on the user's back are top handle area and the side near the bottom of the bag.



restricted.



- Positioning the bag on the chest is an easy solution to being able to reach all areas of the bag without having to take it off.

Final solution: Having a front pack which holds essential camera equipment and a backpack that holds extra equipment that doesn't need to be accessed as frequently. To have the backpack have side pockets near the waist or near the top handle.

How backpack connects to backplate



- The carabiner solution worked well for universality, just needed to adapt the shape to fit the Vertepac backplate.



- Buckles were easy to latch and detach.



- Clips were very difficult to use and took a lot of strain and pressure to latch/unlatch.



- Hooking on the bag was a quick latching solution but there was a risk they would break due to all the weight and pressure.

Final solution: Combination of buckles for Vertepac-made bag and carabiner style clip built into the Vertepac plate for universal bag use.

Organise/customising gear loadouts, loading and retrieval of gear

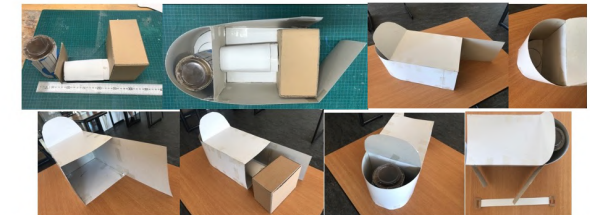


- Woven paper was used to replicate how some compartments could be clipped on. The idea of compartments with clips built-in was discarded as it was not a secure solution. Woven fabric may still be used in case photographers want to clip items or gear on.

Action (front) pack size and shape



The initial front pack design had too much space, and its primary function was to store essentials that were needed for quick retrieval, which included a few batteries, a spare lens and camera.

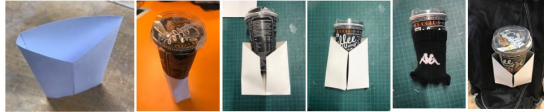


Final solution: From my research, client feedback and interviews with professional photographers it was decided that one camera fitted with a lens to be on-the-go would be needed as well as 3 batteries as they run out very quickly and are needed to be replaced frequently. Alongside this, one spare lens will be stored which can be exchanged for different distances.

Chapter 2 - Process

Testing:

Securing and cushioning of items



- External lens compartment. Material was inflexible so an elastic fabric was implemented. The 'lens' fit in. However, it was not protected from the elements such as rain, dirt or any impact. A cushioned lid will be added.



- Internal sliding dividers. Camera body and lens both fit. Sliding panels are a good and versatile solution to storing different gear sizes.



- External Velcro lens and bottle holder. Needs to be tight to hold lenses or bottles secure. Provides little protection.



- Elastic lens holder. Due to elastic components, can adjust to different lens widths. The holder can be folded up when not in use and allow for space for other gear.



- Battery compartment. Batteries stored in an easy to reach location, stacked in a linear fashion with the top easy to pick out.

Final solution: Internally, batteries will be stored in the same tested compartment but with Velcro on the back to be removable when not used to save weight and increase space. Internal lenses will use the tested elastic lens holder solution as it is a versatile solution to securely holding a variety of lens sizes. Camera bodies will use the sliding dividers as it is a compact and easily customizable method of storing camera bodies as well as other gear. Externally, a lens compartment will be used but with a top flap to protect the lens from water, dirt and any other damage while being easy to access.

Backpack size and shape

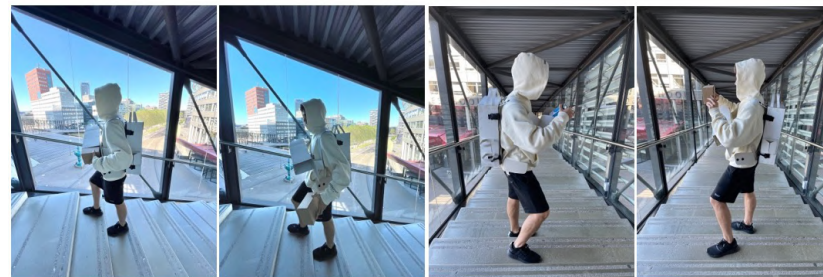


- The initial backpack had unused space on the top of the interior as well as near the zipper.



Final solution: Cut down the depth to fit camera bodies at the bottom, with batteries in the middle and lenses at the top. This way there is no wasted space and holds the essentials. Compartments and dividers can be removed/moved around quickly and easily to hold a variety of different gear.

Physically testing the front action pack with the backpack



Final insight: The front pack did not hinder any forward or side rotation as well as when traveling on an inclined/ declining surface. The backpack was slim, held all the camera gear needs and the front pack was easy to reach the camera and put it back in.

Testing conclusion:

The initial goal of the testing was to see if the sketched concept could be prototyped in the proper dimensions and work. This involved determining how well gear could be stowed or removed from compartments, as well as determining how different loadouts could be modified. To identify the optimal method, the front and backpack connection options were also evaluated.

Overall, prototyping and testing was done to make the concept more complete, the carrying system design was strengthened in terms of adjustability, mobility, functionality, structure, size, and convenience of accessibility.

Final prototype

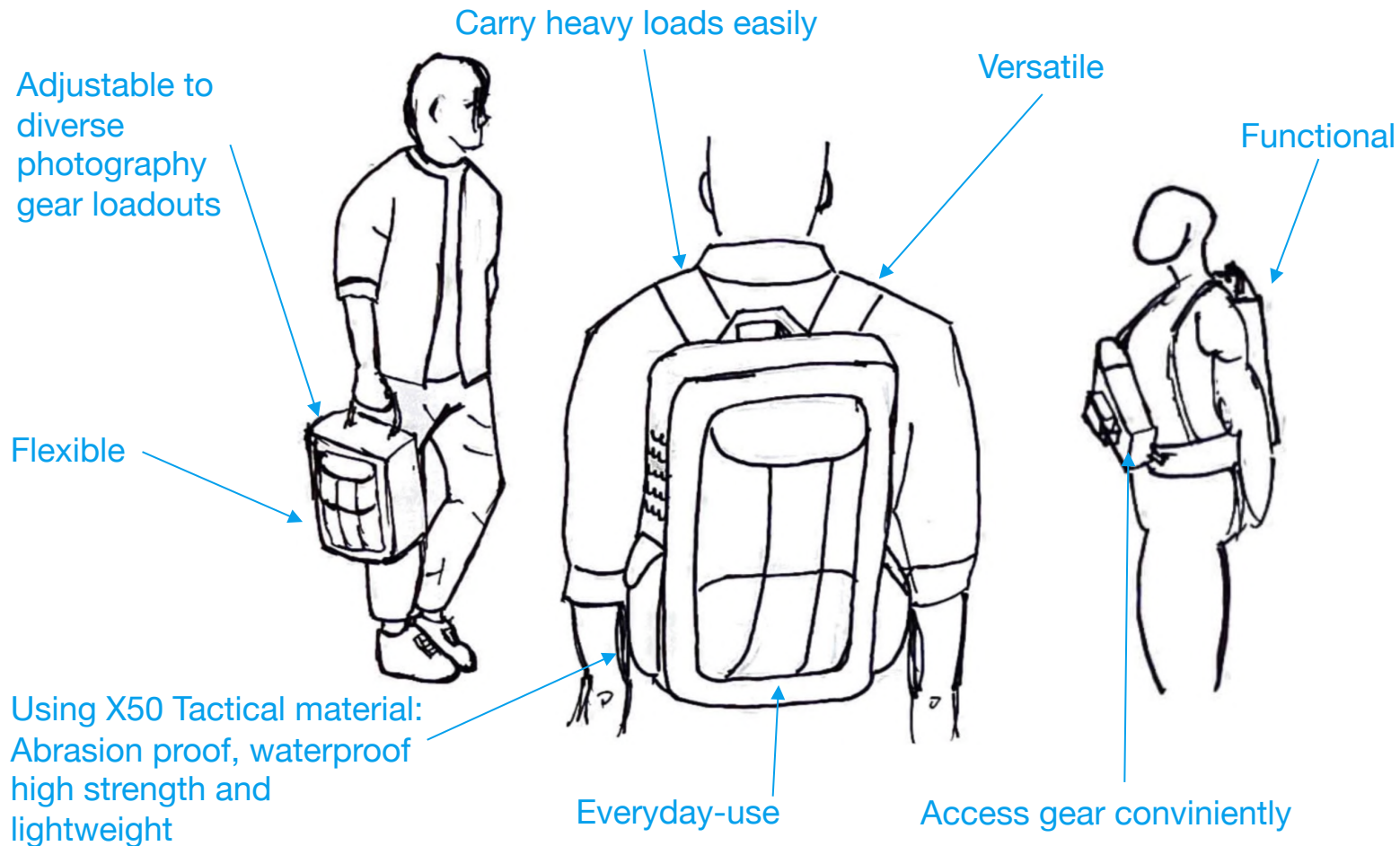


Chapter 3 - Solution

The Action Pack

Key features: Why it is the best solution

Welcome to the Action Pack. A functional, adaptable, everyday-use camera-transport-oriented system that lets the user accommodate to a wide range of camera gear load-outs and conveniently access gear while making large loads simple to carry by utilizing specialized materials and Vertepac technology.



Problems addressed:

- Photographers, both avid and professional, have very different gear needs and bags are wastefully tailored to specific camera models
- Transporting heavy and fragile equipment on a daily basis causes stress and discomfort on the body overtime
- It is difficult to manoeuvre with a heavy product on the back
- Lack of accessible pockets
- Equipment needs a lightweight solution to being protected from different environmental conditions
- Need to take off the bag in order to access or store items conveniently
- Difficult to organise items
- Photography carrying systems need to be durable, especially if used frequently

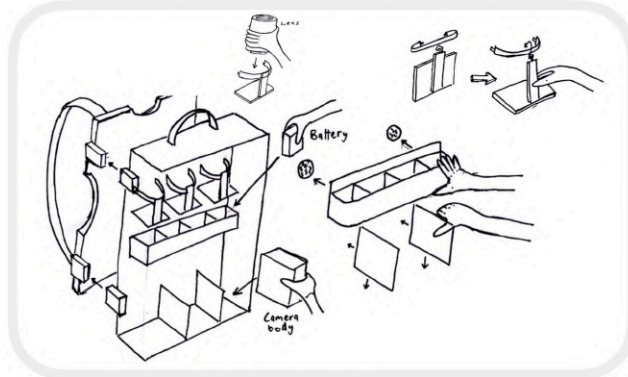
Chapter 3 - Solution

Product usage and visual style

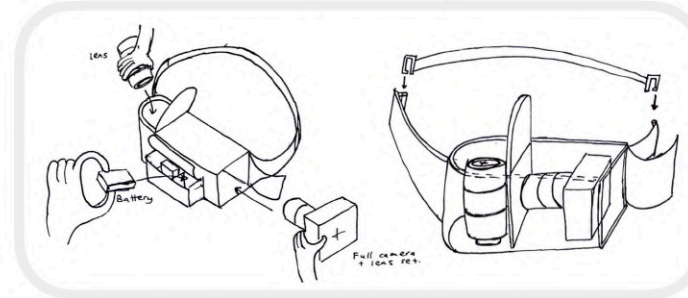
How the carrying system is worn



How compartments are used



Inserting camera gear



Visual style

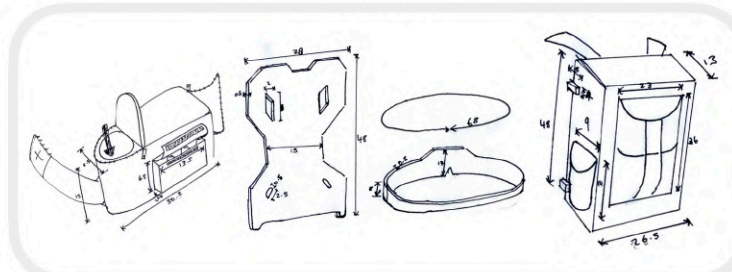
- Camo
- Black
- Stealth gray
- Coyote brown
- Khaki



Colour ways



Dimensions

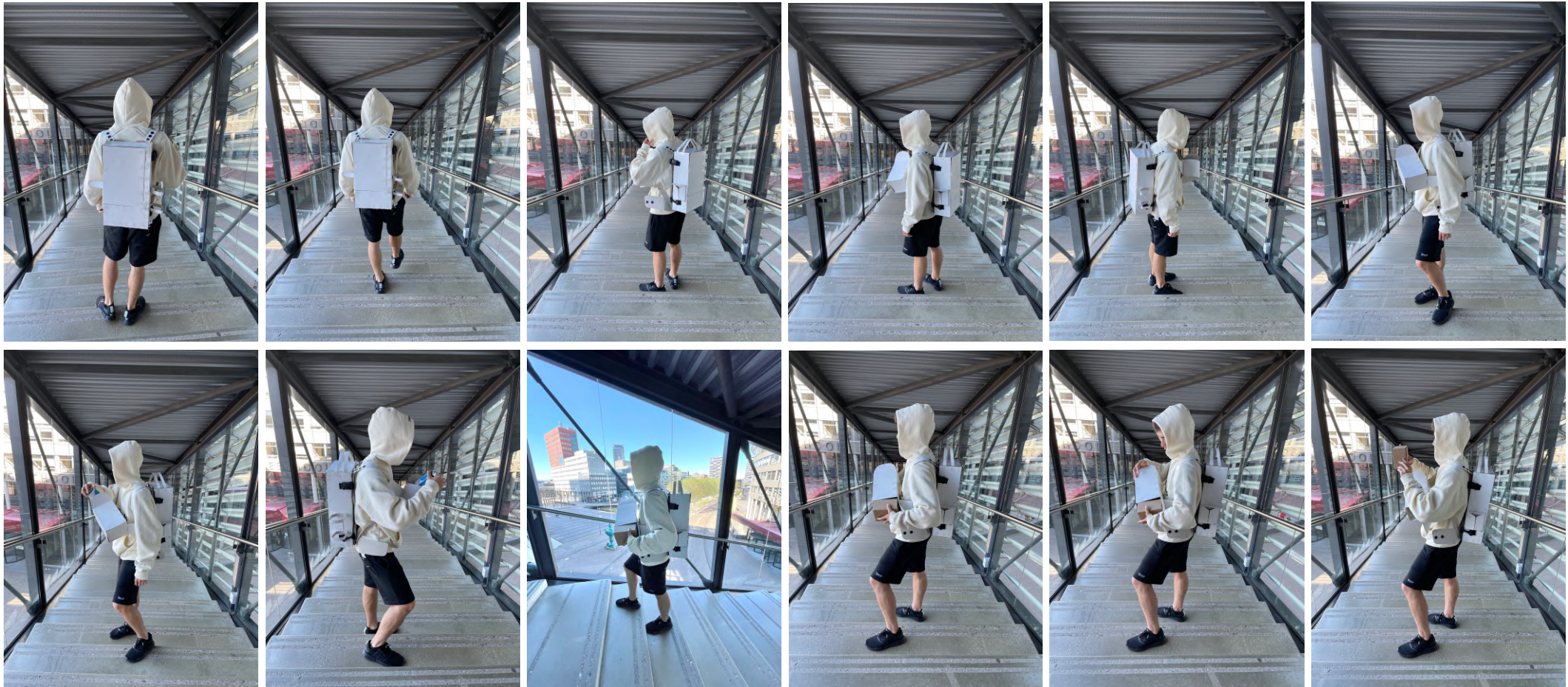


Recommended material
X50 Tactical from dimension
polyant

Recommended manufacturing
High frequency ultrasonic
vibration

Chapter 3 - Solution

Final prototype



Chapter 4 - Reflection

Evaluation against the requirements

D/V/F	Criteria	Requirement	Specification	Hard /Soft	✓/X
Desirability (User)	User experience	Reduce the stress on the user's back. Comfortable and usable for various lengths of usage	Can put on/taken off the bag in less than 4 steps and without significant/uncomfortable strain	Hard	✓
			Cannot take away from the user's energy or productivity or capabilities over time, not stress inducing	Soft	✓
			Mobile, flexible, fits well to the user and efficient to use	Soft	✓
			Back plate must allow airflow and heat dissipation	Soft	✓
			The backpack should have a solid base to rest upright	Soft	✓
			Ergonomic backplate shape that covers a large area	Soft	✓
	Ease of use, intuition of use	Compartment placement must be easy-to-reach.	Retrieve/store internal items from compartments in less than 2 steps	Hard	✓
			Easy to reach zippers and external fixtures locations	Hard	✓
		Adjustability/ versatility/ fit different camera gear sizes	Customisable interior compartments and dividers for different loadouts and camera gear sizes (including lenses, camera bodies, sd cards, drone and batteries) to meet multiple photographer type's needs and variety of activities	Hard	✓
	Aesthetic (color + design)	The design's shape or form does not clash with the needs of the user	Appearance of the carrying system should not clash with the appearance of nature and surroundings	Soft	✓

Feasibility (Technological)	Strength/structure	Shoulder straps should be able to hold all the bag weight on a single strap	Cushioning, thick (more than 10mm) straps with a large surface area (more than 15mm wide).	Hard	-
	Materials	The design should use smart materials	Easy to clean materials	Soft	✓
	Secure and protect camera gear	Durable to withstand conditions of rain, dust, snow, heat and cold	External materials must be waterproof, abrasion resistant, lightweight and insulating	Hard	✓
			Internal battery compartment must use fireproof in case of fire	Soft	X
		Must have detachable components	Detachable components can be taken off/put on in less than 2 steps using gloves	Hard	✓
	Size + weight measurements	Users should not hold more than 15% of their body weight in a backpack	Bag must not exceed 8.4kg (10% of average adult male weight)	Hard	-
		Balance and weight composition.	Compartments for batteries + lenses near the bottom for a lower center of gravity or near the user	Hard	✓
		Meet aeroplane carry-on requirements	Meet size requirement of 55X35X25cm(KLM)	Hard	✓
			Meet carry-on weight requirements of 12kg (KLM)	Hard	-
		The carrying system can be shared and used by different users of the 5th to 95th percentile of 18-54 yr olds	Average sized male hand size of 19.3cm should be able to access internal spaces	Hard	✓
	Capacity	Internal compartments must be versatile and adjustable for different camera gear shapes and sizes	Accommodate several camera bodies, spare lenses and many batteries.	Hard	✓

Key:

✓	Met requirement
X	Did not meet requirement
-	Further testing/development needed

Viability (Business)	Cost	Price	Price \$359 or less	Hard	-
	Manufacturing	Minimize energy consumption using low-energy manufacturing processes which use low requisite temperatures and pressures of processes.	To minimise waste by using low/no waste manufacturing techniques	Soft	✓
		Production type	To be able to manufacture using affordable batch production techniques. Carrying systems will be manufactured over a period of time, rather than all at once in bulk	Soft	✓
		Life cycle	The chemicals and processes used should minimise harm for the environment and nature during its life cycle	Soft	X

Chapter 4 - Reflection

Evaluation against client specification

Client initial specification

- Smartly store and protect
- Connect to Vertepac
- Base characteristics of Vertepac must be present
- Keep human anatomy in the centre. Must be an extension of the user
- Lightweight
- Cost efficient
- Comfortable
- Silent
- Free + mobile
- Smart materials

✓
✓
✓
✓
✓
X
✓
X
✓
✓

The carrying system could have been more cost efficient but was a difficult balance as lightweight, smart materials needed to be used which were relatively costly. If a more reasonable smart material is found then the carrying system may change to that material choice.

The product relies on Velcro in many components and parts as a closure or fixation method. This can be loud and disturb the nearby nature or environment so buckles and clips would be a better more silent choice.

Assessing values in the product

- Freedom
- Balance
- Comfort
- Creativity
- Confidence/reliability
- Change/innovation
- Unite

✓
✓
-
✓
✓
✓
-

Many values were integrated into the design after research on the target group and client. These key values were highlighted due to it meeting Vertepac and the researched target groups values.

Creativity, freedom, change were all promoted as a result of the carrying system's ability to be able to adapt to any situation and allow for any photographer's gear needs to be stored. I believe the product is fighting for change and can show photographers and videographers alike how current camera carrying system methods are behind the innovation curve.

Reliability is a value that was strived for, particularly with the carrying system having gear ready at hand as well as being easy and intuitive to use.

Balance, comfort and uniting were all encouraged but need to be tested further. The balance of the carrying system is ideal as the gear is stored as close to the user as possible, allowing for the user to feel united with the gear and carrying system. The Vertepac backplate and spine allow for optimal comfort due to the weight being distributed to the waist of the user and not on the shoulders.

Chapter 4 - Reflection

Future design modifications and improvements

I would also develop the cushioning and protection of my designs better because I did not thoroughly investigate and test alternative solutions.

If I were to continue this project, I would undertake more physical testing with expert photographers, get feedback and then improve as a result of that input.

The client suggested that I should use less Velcro because it is a heavy connection solution that causes a lot of noise and may disturb wildlife. He recommended I replace it with clips or buckles so I would do that.

I would like to have tested it further with drone and videography equipment, but it was difficult with cost restraints and the pandemic. In the future, I would like to have a prototype made of more realistic cloth material and take it to a drone or videography store and see how it could be improved to adapt and involve different equipment.

Did the final product achieve the initial design challenge? Was the project successful?

The initial design challenge was to design a bag that could accommodate the demands of the target group in a flexible bag that could be worn comfortably for long periods of time yet offering acceptable gear protection.

I believe I achieved this design challenge as I spent a lot of time researching the necessary gear requirements, the sizes and shapes of the gear and cushioning of the gear so it does not rattle around and stays protected from external impacts and weather. I think that potential consumers will recognize the product's unique selling qualities and evident benefits over competing camera carrying goods in the market as a flexible, easy to customize, easy to access, mobile, high quality, lightweight, waterproof solution that protects equipment. Scale paper prototypes were created and tested to have a good awareness of the gear that it can carry and protect.

In order to accomplish this design challenge more fully, I would test the product against CAD simulations to see how it can hold with heavy forces. I would also get valuable feedback from the target group so it can be presented with confidence as product that has a low chance of failure if released into the market. Due to time, material and manufacturing restrictions, it was not possible to make prototypes out of textiles/fabrics and test cushioning. I would try to send a design to the client's manufacturer and see if they can send it so I can test it with camera gear. I would also place eggs in the bag and do a variety of shock and vibration tests to see how the eggs would last.

Professional photographer evaluation