

Topic: Integrated Product Development

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Introduction of the investigated Product

We try to come up with a new kind of backpack. The idea is to produce a very light yet durable backpack. It should be flexible and as compact possible. The differentiation criteria from other backpacks is the full waterproof implementation.

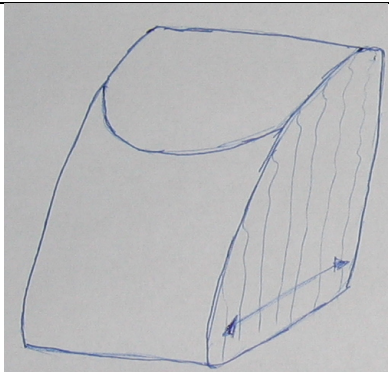
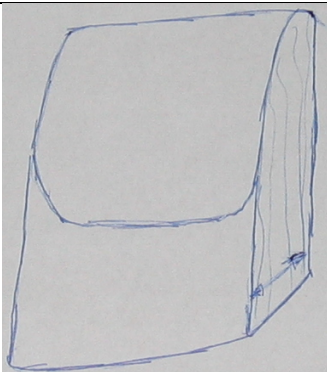

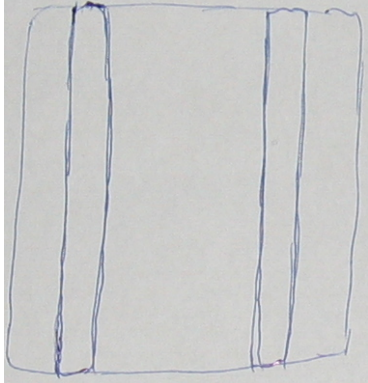
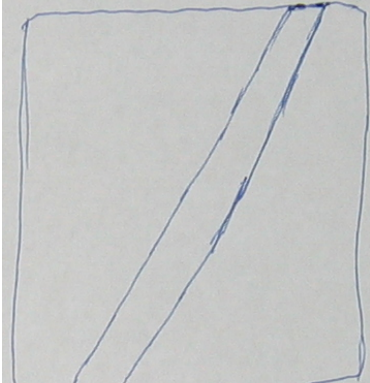
Possible materials for the bag:

- Cotton
- Linen
- Synthetic fiber (e.g.: Kevlar)

Possible materials for the support:

- Steel
- Titan
- Glass-fiber enforced plastic

Some sketches of the product:

		
Filled backpack	Empty backpack	Side view
		
Back view, two stripes	Back view, one diagonal stripe	

Description of Competitive Products

Interesting competitors are Deuter, Vaude and Tatonka. The following three backpacks are examples from a small backpack with laptop support, up to a huge tracking backpack.

		
<p>Deuter GIGA OFFICE Color: black Weight: 1.28 kg Volume: 30 l Measures: 47 x 36 x 26cm Laptop max. 36 x 30 cm</p>	<p>Vaude Crystal Rock 30 Color: metallic/anthracite Weight: 1.36 kg Volume: 30 + 6 l Measures: 50 x 28 x 18 cm</p>	<p>Tatonka Bison 90 Color: green, black Weight: 3.5 kg Volume: 90 l Measures: 90 x 36 x 31 cm</p>

Survey: Backpack X

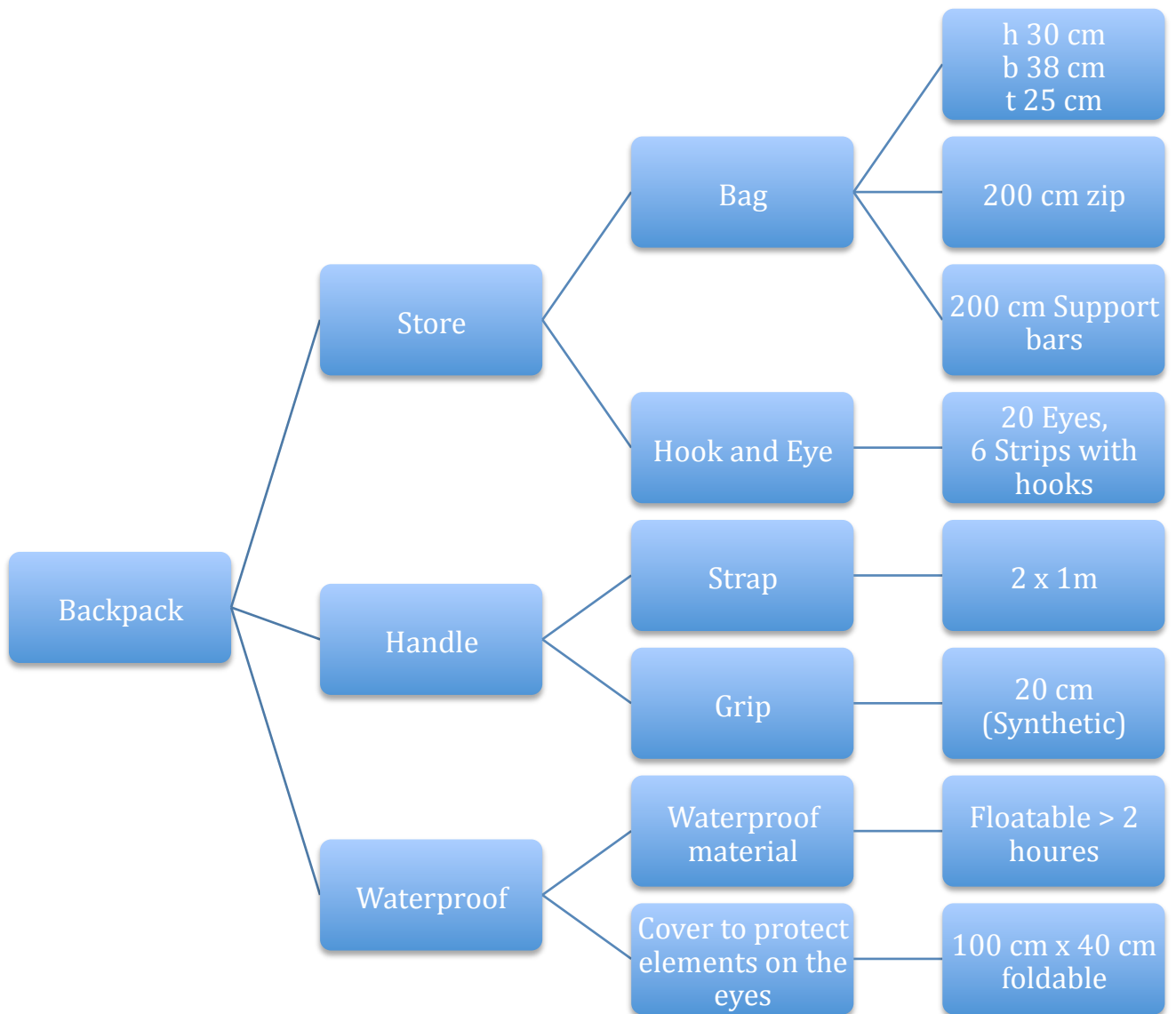
Question	Answer Please check one answer per question.	Priority 1 to 5 1 .. very important 5 .. I don't really care
How much weight should the empty backpack maximal have?	<input type="radio"/> 1 kg <input type="radio"/> 2 kg <input type="radio"/> 3 kg	
What volume should the backpack offer?	<input type="radio"/> <15 l <input type="radio"/> 15-30 l <input type="radio"/> >30 l	
How much payload should the backpack handle?	<input type="radio"/> <20 kg <input type="radio"/> 20-40 kg <input type="radio"/> >40 kg	
What color do you prefer?	<input type="radio"/> Blue <input type="radio"/> Black <input type="radio"/> Red	
Should the backpack be waterproof?	<input type="radio"/> Yes <input type="radio"/> No	
Would you like a notebook pocket inside the backpack?	<input type="radio"/> Yes <input type="radio"/> No	
How should the backpack be washable?	<input type="radio"/> Machine <input type="radio"/> Hand	
Would you like to have outside pockets on the backpack?	<input type="radio"/> Yes <input type="radio"/> No	
Do you prefer two shoulder straps or one diagonal strap?	<input type="radio"/> 1 <input type="radio"/> 2	
How much do you think is a good backpack worth?	<input type="radio"/> <50 € <input type="radio"/> <100 € <input type="radio"/> <200 € <input type="radio"/> >200 €	

Survey Results

Question	Answer	Survey												Sum	Avg
		1	2	3	4	5	6	7	8	9	10	11	12		
How much weight should the empty backpack maximal have?	1 kg	3				5	5	5	4			3	2	27	3.9
	2 kg			5						1				6	3.0
	3 kg		1	4		5								10	3.3
What volume should the backpack offer?	<15 l		1					4						5	2.5
	15-30 l	5		3	2	4	4			2		4	5	29	3.6
	> 30 l								5		1			6	3.0
How much payload should the backpack handle?	< 20 kg		2					2		5				9	3.0
	20-40 kg	5		4	4	5	4		4		4	4	5	39	4.3
	> 40 kg													0	
What color do you prefer?	Blue	2		3					1	1				7	1.8
	Black		3			3	2	2				3	2	15	2.5
	Red				1						1		2	4	1.3
Should the backpack be waterproof?	Yes	4	1	3	5	2	4	4	5	1	2	5	5	41	3.4
	No													0	
Would you like a notebook pocket inside the backpack?	Yes		2			4		5	3	1	1	5		21	3.0
	No	1		1	1		1						1	5	1.0
How should the backpack be washable?	Machine	4	1	5	3	2				3		2	4	24	3.0
	Hand							3	3	3		5		14	3.5
Whould you like to have outside pockets on the backpack?	Yes	3	3	5	5	5	4	2	5		1	4	4	41	3.7
	No									5				5	5.0
Do you prefer to shoulder straps or one diagonal strap?	One									2				2	2.0
	Two	4	2	5	4	5	4	4	5		3	5	5	46	4.2
How much do you think is a good backpack is worth?	< 50 €		1	4			5							10	3.3
	< 100 €	4			4	5		2		2		3	4	24	3.4
	< 200 €								5		3			8	4.0
	> 200 €													0	

We see the need for a light backpack is here. Another important fact is that a payload of 20 kg to 40 kg is desirable. A backpack should be washable and it must have tow straps. Our prime goal to produce a total waterproof backpack is accepted by the customers.

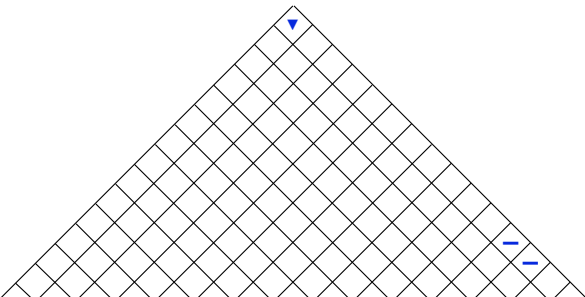
Functional Decomposition



House of quality

Aim: offer transport aid

Title: Backpack X
 Author: Markus Loberbauer
 Date: 5/9/08
 Notes:



Legend	
⊗	Strong Relationship 9
○	Moderate Relationship 3
▲	Weak Relationship 1
++	Strong Positive Correlation
+	Positive Correlation
-	Negative Correlation
▼	Strong Negative Correlation
▽	Objective Is To Minimize
▲	Objective Is To Maximize
X	Objective Is To Hit Target

Row #	Max Relationship Value in Row	Relative Weight	Weight / Importance	Demanded Quality (a.k.a. "Customer Requirements" or "Wishes")	Direction of Improvement: Minimize (▼), Maximize (▲), or Target (X)																Competitive Analyses (0=Worst, 5=Best)										
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	0	1	2	3	4	5					
1	9	11.1	3.9	Max Weight 1kg	○	○	○						○	○		▲			▲									Backpack X	Deuter	Vaude	Tatonka
2	9	10.3	3.6	Volume 15-30 l		▲	▲																								
3	9	12.3	4.3	Payload 20-40 kg		○	○	○																							
4	1	7.1	2.5	Color Black	▲				▲																						
5	9	9.7	3.4	Waterproof	○		▲	○	○	○				○		▲						○									
6	3	8.6	3.0	Notebook pocket				○						○																	
7	9	8.6	3.0	Mashine washable	○	▲	○	○	○	▲				○	▲		○					○									
8	9	10.6	3.7	Outside pockets			○	○						○		▲															
9	9	12.0	4.2	Two straps							○																				
10	9	9.7	3.4	Price max. 100€	○	○	▲	▲		▲	▲			○	▲	○						▲		○							
Target or Limit Value					100 kN / m ²	2 kN / mm ²	10 kN	100 kN / m ²	10 kN	100 kN / m ² on at least 1 m length	30 kN	2 g / cm ³	≤ 100 g	100 kN / m ²	0.45 m	30 Yrs UV proof	457 kPa max. 80 m, 250 lbs	1 m	400 g/m ²												
Difficulty (0=Easy to Accomplish, 10=Extremely Difficult)					7	7	6	3	5	5	1	4	1	6	1	2	9	9	1	10											
Max Relationship Value in Column					9	9	9	9	9	9	9	9	9	9	1	3	9	9	3	9											
Weight / Importance					396.3	208.3	323.7	159.7	171.7	105.7	228.3	301.7	530.0	116.6	42.6	45.1	164.6	69.7	373.7												
Relative Weight					12.2	6.4	10.0	4.9	5.3	3.3	7.1	9.3	16.4	3.6	1.3	1.4	5.1	2.2	11.5												

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Conclusions

The most important thing for this project is: the material the backpack is made of it affects the waterproof nature and the targeted minimum weight as well as the price.

The second important thing is the modular design with the interfaces for attachments like pockets. This makes the backpack light in a base version and modular extendable to carry more if needed.

The third thing to consider is the support bar system and the straps, as they need to be light and robust. The straps and support bars are permanently connected to the backpack to be as robust as possible, thus attention must be given to them to meet the lightness criteria.

Finally the HOQ shows, the project should be continued, as the competitors don't satisfy the market for waterproof backpacks.

Suggestions to Improve the Backpack

Plug-able water system

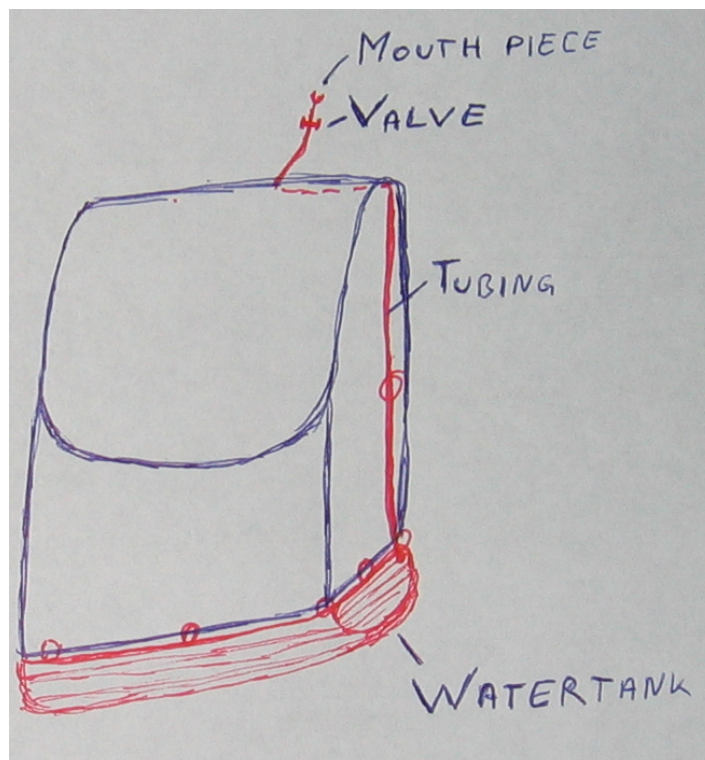
Extend the backpack with a pluggable drink water system. Basically it is a food save plastic bag with tubing and a valve. Bags can be produced in different sizes. The bag can be connected with the planned modular infrastructure.

Costs: Low

Production time: Low (can be outsourced)

Environmental issues: No problem

We should implement this feature.



Air-conditioned back

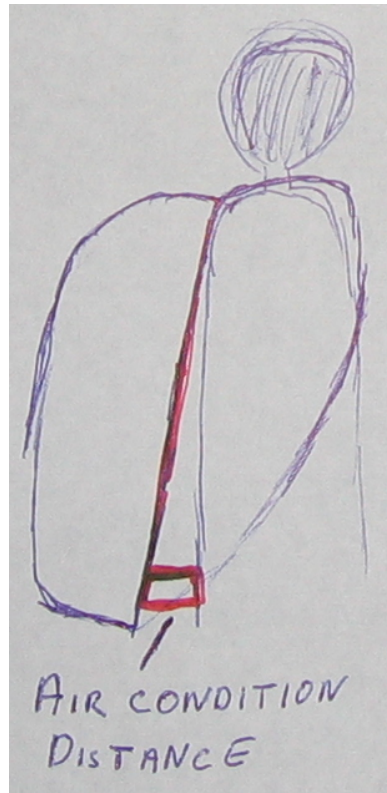
Extend the support cage with a possibility to provide a distance to the back of the user. The distance must be adjustable for maximal comfort.

Costs: Low (should be done in-house)

Production time: Low

Environmental issues: No problem

We should implement this feature.



Transformable to a (rain) jacket

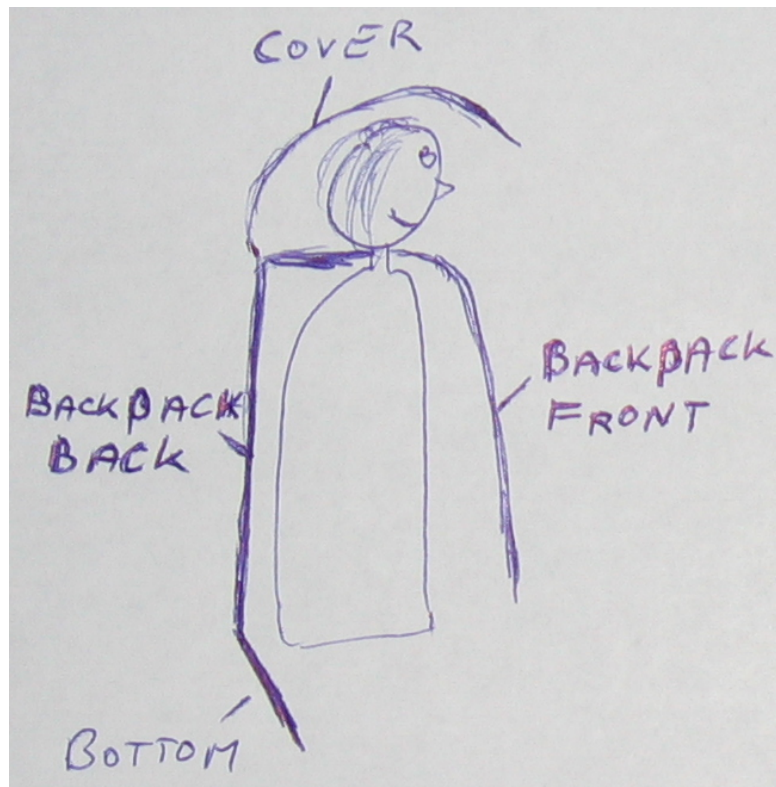
In case of emergency this backpack could be dismantled to a waterproof jacket.

Problems: Increases weight, weakens the structural integrity (in opposite to washable, light, waterproof)

Costs: Development Medium, Production High

Environmental issues: No problem

We should NOT implement this feature.



Split the full backpack into a smaller, lighter one and some rest

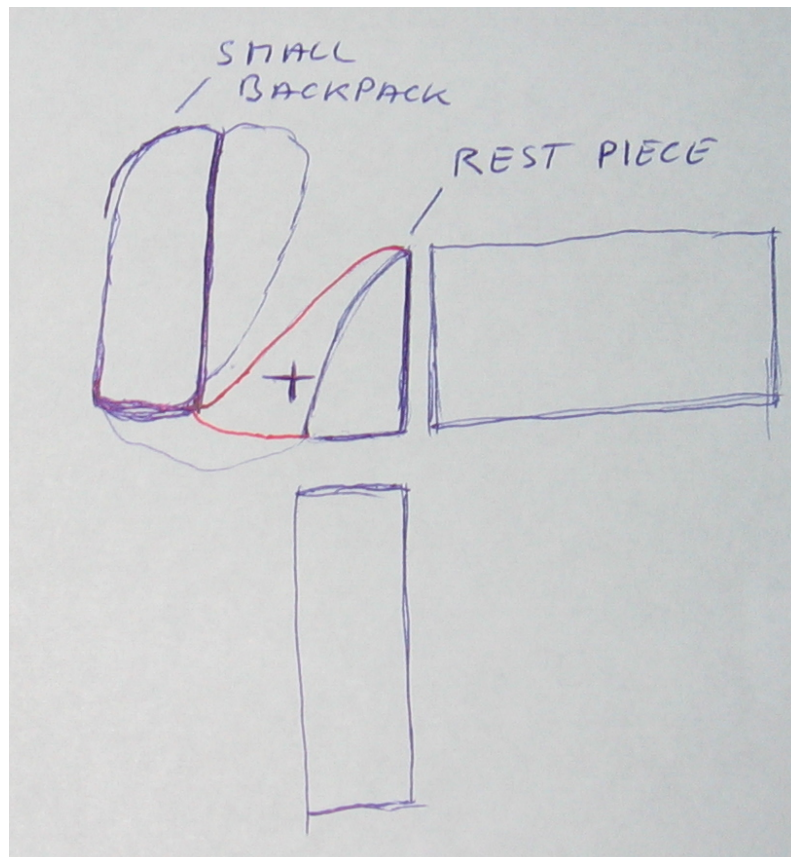
Enable the sides to be removed, thus a lighter smaller backpack results.

Problems: Weakens the structure (in opposite to washable, light, waterproof)

Costs: Development Low, Production Medium

Environmental issues: No problem

We should NOT implement this feature now, maybe later.



Integrated survival pack

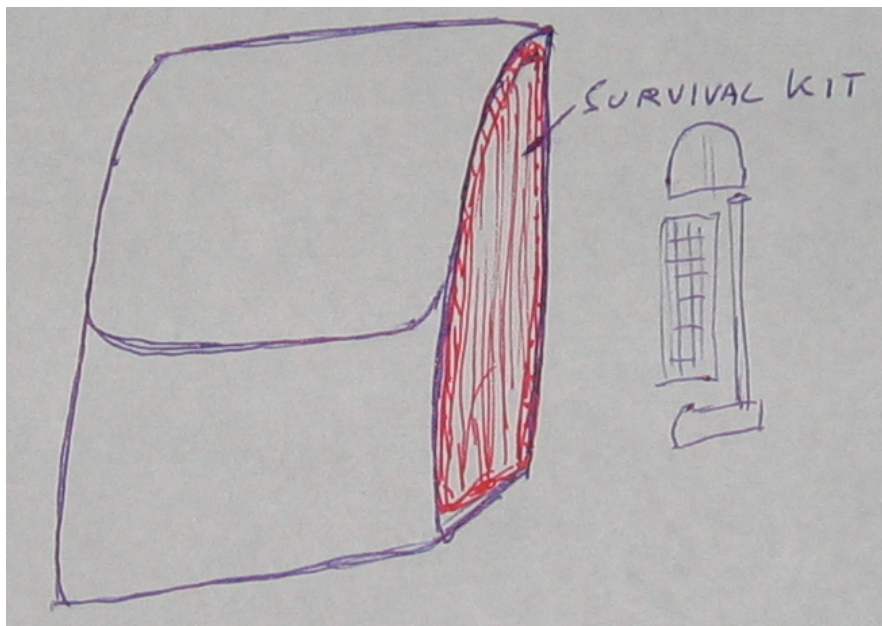
Add optional packages, for example a survival pack. The pack can be attached over the module interfaces on the backpack.

Costs: Development middle (outsourced would be good, we do not have the expertise), Development middle.

Environmental issues: No problem

We should implement this feature only after a customer survey.

Possible contents: axe, shovel, foldable tent, hammock, knife



Net Present Value

Cost estimates x 1000€	1. year				2. year				3. year				4. year			
	1. q	2. q	3. q	4. q	1. q	2. q	3. q	4. q	1. q	2. q	3. q	4. q	1. q	2. q	3. q	4. q
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Development	-125	-125														
Ramp-up		-250														
Marketing and support			-250													
Production	0	0	-180	-300	-300	-300	-300	-300	-600	-600	-600	-600	-600	-600	-1200	-1200
Production volume			3000	5000	5000	5000	5000	5000	10000	10000	10000	10000	10000	10000	20000	20000
Unit production cost			-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06
Sales revenues	0	0	100	200	450	500	500	600	850	900	900	1000	1000	1000	1500	1800
Sales volume			1000	2000	4500	5000	5000	6000	8500	9000	9000	10000	10000	10000	15000	18000
Unit price			0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Profit	-125	-375	-405	-175	75	125	125	225	175	225	225	325	325	325	225	525
Total profit	-125	-500	-905	-1080	-1005	-880	-755	-530	-355	-130	95	420	745	1070	1295	1820
	-125	-365.854	-385.485	-162.505	67.9463	110.4818	107.7871	189.2847	143.6306	180.1639	175.7696	247.6971	241.6557	235.7616	159.2386	362.4944
NPV	1183.1															
Discount rate/q	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Development	-250															
Ramp-up	-500															
Marketing and support	-1050															
Unit production cost	-2															
Production volume	128000															
Sales volume	113000															
Unit price	3															

Backpack X will be developed over a half year, by eight developers and designers. We need to build factories for the sawing and the impregnation, this will approximately take another half year but it can be started in the second quarter.

We start the start the sale in Austria and the neighboring countries. The sale will be extended over whole Europe in the first three years. By the fourth year we plan to expand to the USA.

The net present value is about 1.2 million € for the first four years.

Alternative Net Present Value

Cost estimates x 1000€	1. year				2. year				3. year				4. year			
	1. q	2. q	3. q	4. q	1. q	2. q	3. q	4. q	1. q	2. q	3. q	4. q	1. q	2. q	3. q	4. q
Development	-125	-125	-250	-75	-75	-75	-75	-75	-75	-75	-75	-75	-75	-75	-75	-75
Ramp-up		-250														
Marketing and support																
Production	0	0	-300	-300	-300	-300	-300	-600	-600	-600	-600	-1200	-1200	-1200	-1200	-2400
Production volume			5000	5000	5000	5000	5000	10000	10000	10000	10000	20000	20000	20000	20000	40000
Unit production cost			-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06
Sales revenues	0	0	100	200	450	500	800	800	850	1100	1100	1500	1900	1900	2500	3500
Sales volume			1000	2000	4500	5000	8000	8000	8500	11000	11000	15000	19000	19000	25000	35000
Unit price			0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Profit	-125	-375	-525	-175	75	125	425	125	175	375	375	225	625	575	1175	1025
Total profit	-125	-500	-1025	-1200	-1125	-1000	-575	-450	-275	100	475	700	1325	1900	3075	4100
	-125	-365.854	-499.703	-162.505	67.9463	110.4818	366.4762	105.1582	143.8306	300.2731	292.9494	171.4826	464.7224	417.1167	831.5795	707.7272
NPV	2826.5															
Discount rate/q	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Development	-450															
Ramp-up	-500															
Marketing and support	-1050															
Unit production cost	-2															
Production volume	185000															
Sales volume	172000															
Unit price	3															

With our flexible modular system and the full waterproof embodiment the military is interested in Backpack X. By contracting with the army we can more than double the net present value in the first four years.

The contract with the government makes it necessary to reevaluate the backpack and research new extensions for it. This shall be done in the second and third quarter in the third and fourth year.