RHODE ISLAND SCHOOL OF DESIGN

Team 9: Transporting Therapeutic Materials

Assignment #*4* for 15.783

March 10, 2008

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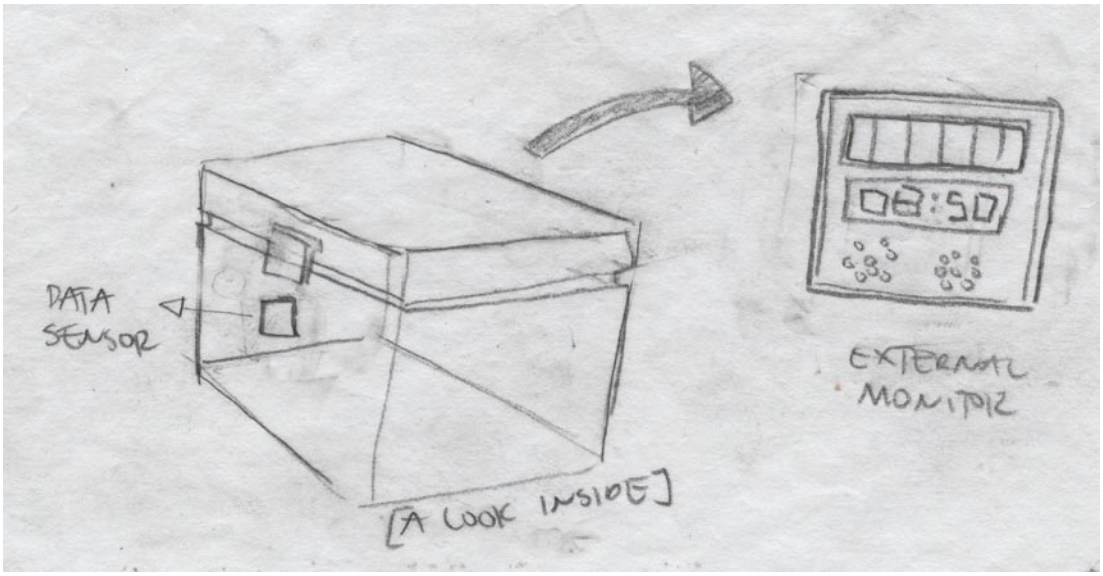
MISSION STATEMENT

Transpeutics aspires to dramatically improve the delivery of therapies to developing nations efficiently and effectively, with the goal of saving millions of lives.

CONTENT

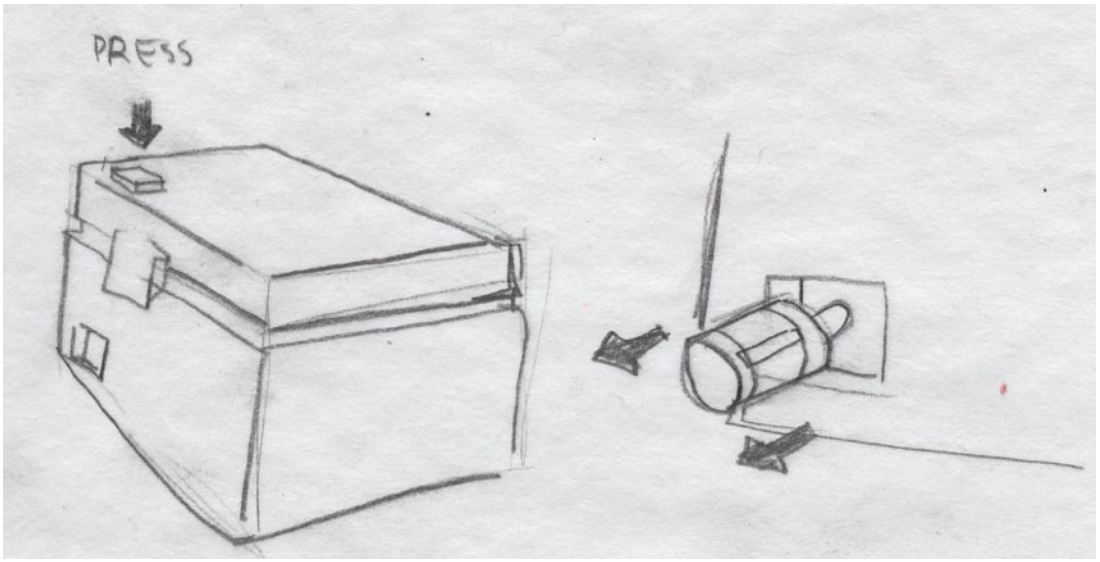
1. Refined Drawings
2. Concept Selection Matrix
3. Gantt-chart schedule
4. Key questions or problems concerning product viability, and strategies to address them
5. Process and Results

CONCEPT 1: TEMPERATURE LOGGING AND MONITORING



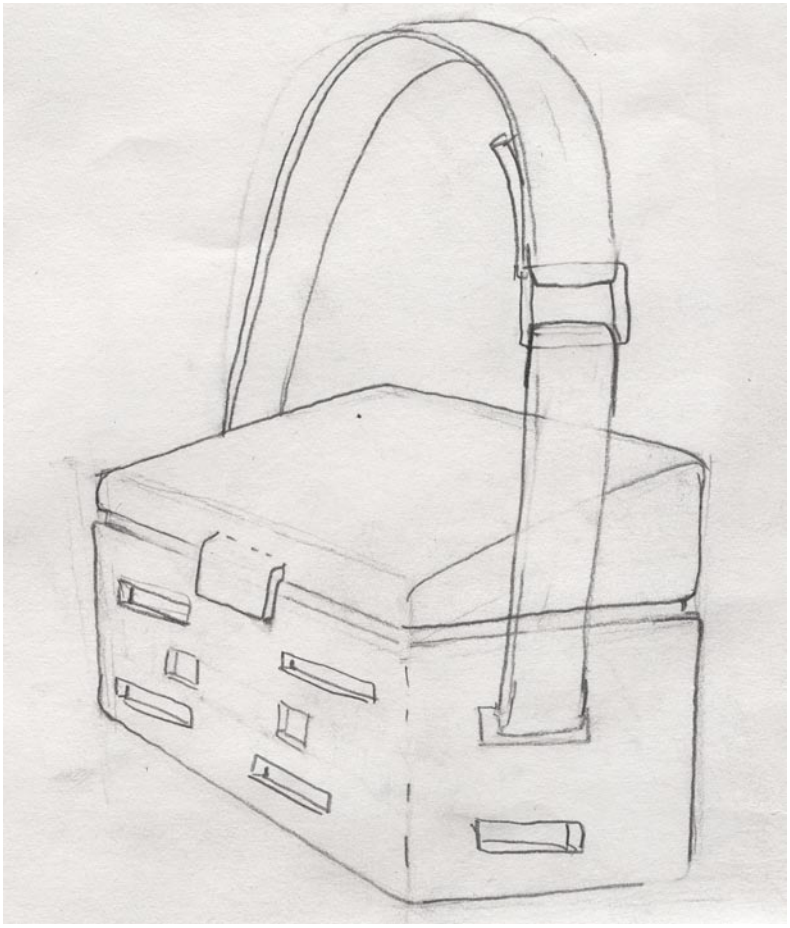
Vaccine transportation goes through a complex cold chain, where a number of players are involved. In order to facilitate the process of temperature log in that is required by WHO standards, and aid in the identification of weak areas within the chain, a temperature monitoring system would be used. A component would be put within the box which would record and transmit data to an external location. Additionally, a simple external indicator would display time and temperature as well as beep to signal a problem in temperature.

CONCEPT 2: VIAL DISPENSER



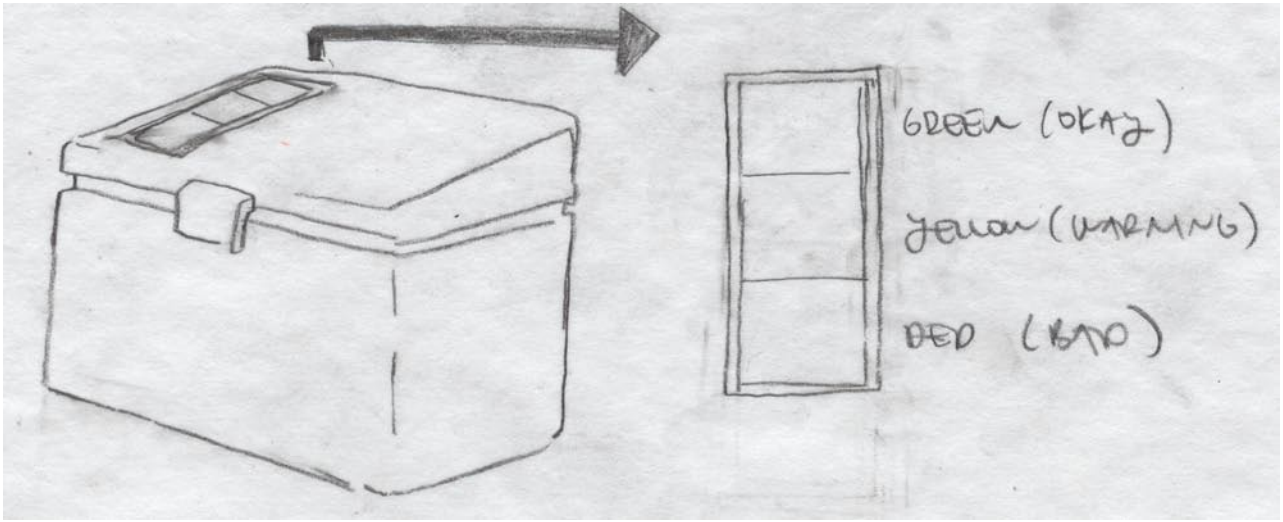
When administering vaccines, the clinical worker must reopen the carrier, risking temperature exposure. With this system, the cooler could retain its temperature for it would not need to be opened after filled with vials, where vaccines would be dispensed for use.

CONCEPT 3: VIAL CARRIER



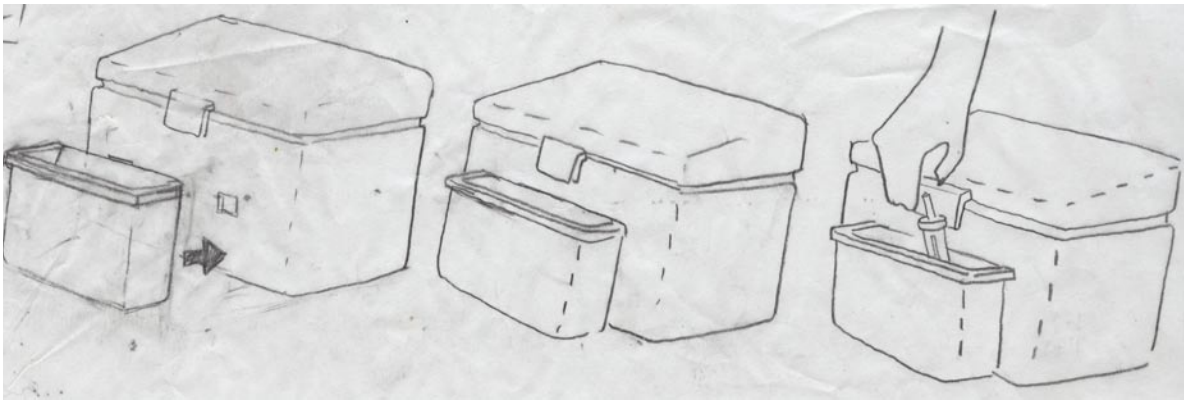
The last leg of the journey is diffiuclt due to the need to traverse long distances to remote locations and the act of administernig the vaccine. Our vial carrier improves on convention, addressing the areas of temperature monitoring, modular components, partitioned storage, and adaptable means of transportation.

A. Temperature Monitoring



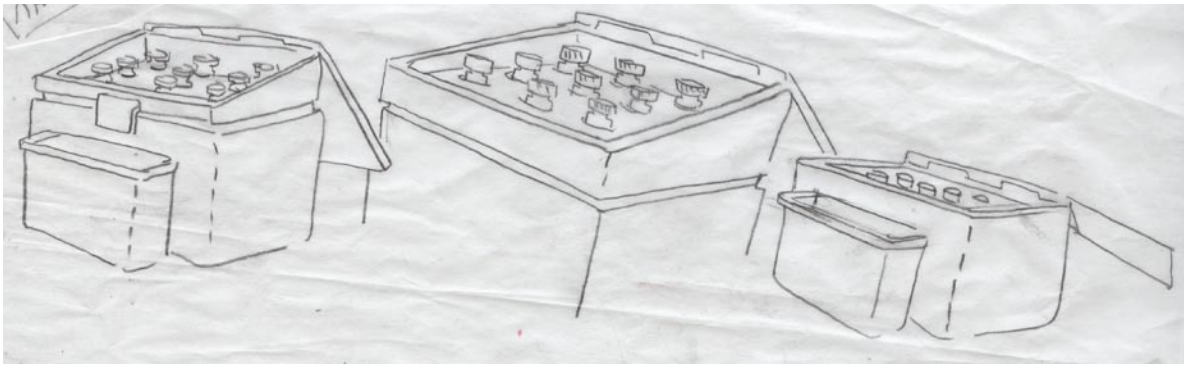
An easy to read display would gauge the temperature of the carrier's inside. If green, the temperature is within the designated range, however if yellow is reached, the inside is near the extremes of the limit. Red indicates that the product has gone bad due to temperature exposure.

B. Modular Components



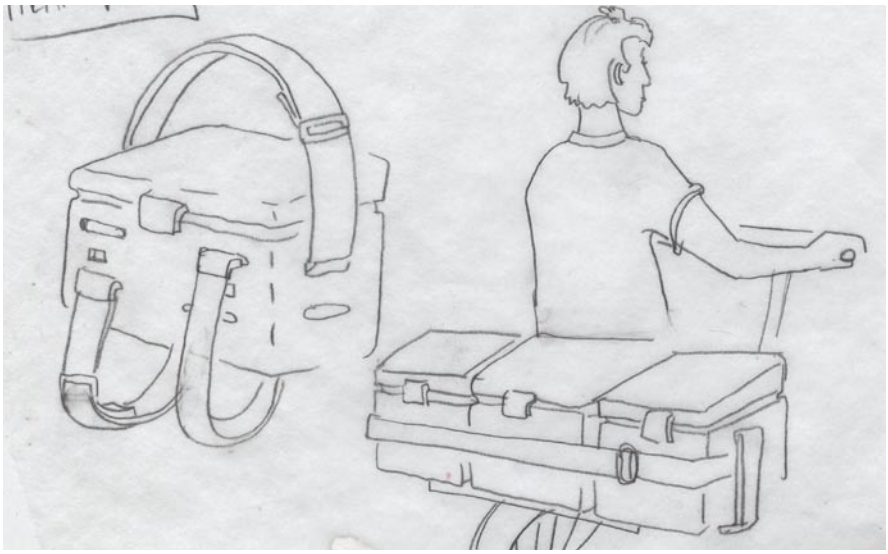
Addressing the difficulty of administering the vaccines, an extra compartment would be able to snap onto the carrier. It could be potentially use for vaccine waste or extra storage.

C. Partitioned Storage



Partitioned storage would protect the majority of vaccines from heat exposure. With such a configuration, a small portion of the box with the vials in use opens up separate from the main chamber.

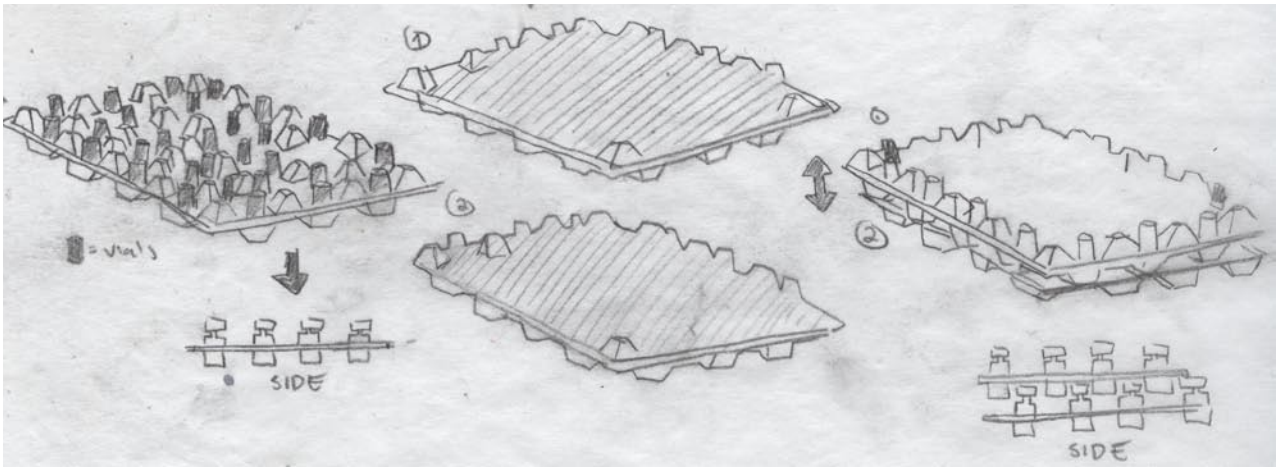
D. Adaptive Straps



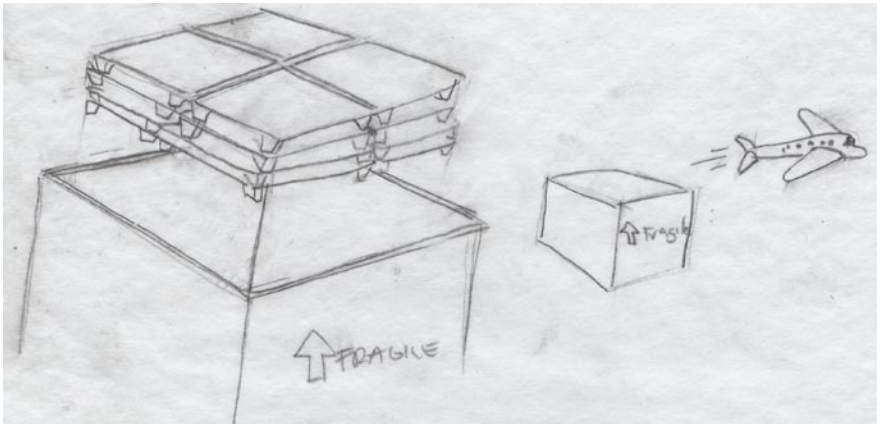
Vial carriers are transported in a number of ways: by foot, car, motorcycle, or bicycle. These straps would move, clip, and adjust to adapt to any situation.

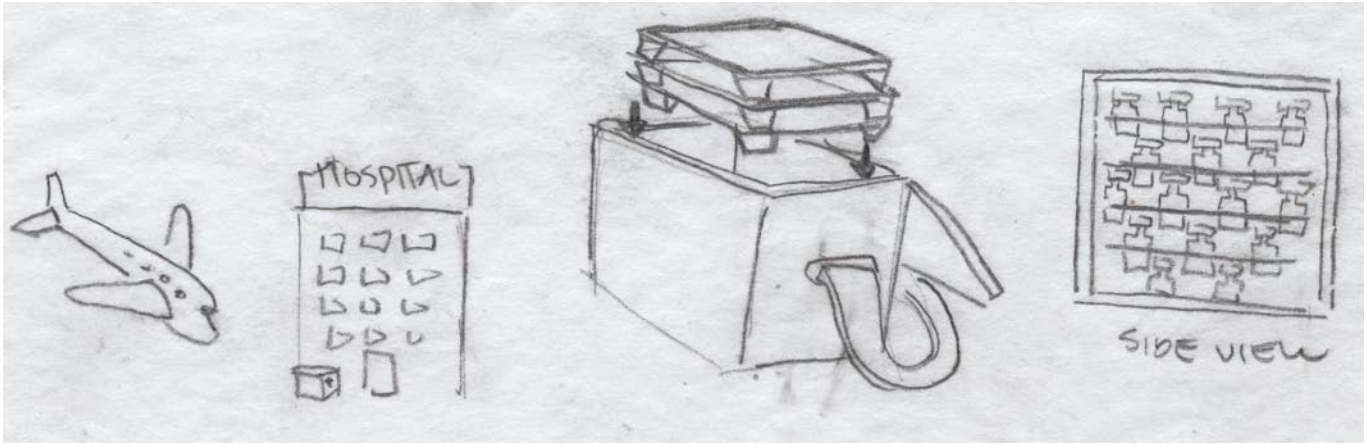
CONCEPT 4: EGG CRATE

A journey for a vaccine requires repackaging and handling at a variety of locations. This packaging would facilitate this process by having the product stay in the same packaging until the end.



The packaging would be disposable, stackable, and made of a material which retains the cold. Many times within the cold chain there are opportunities of spoilage due to problems with infrastructure and management. The latter would help to keep the vials cool if an error were to occur.





The vials would be packaged in a set amount which could stack on top of each other to perfectly fit within a vaccine carrier or beside each other for larger shipments.

BASED ON THE INSTRUCTOR FEEDBACK, WE HAVE SPLIT THE NEEDS INTO THREE INDEPENDENT DOMAINS:

- **COOLING MECHANISM**
- **TEMPERATURE MONITORING AND LOGGING**
- **PACKAGING AND HANDLING**

CONCEPTS (COOLING MECHANISM)

A – Einstein Refrigerator
B – Sterling Refrigerator
C – Evaporation Based Cooling
D – See-Beck Effect based Cooling
E – Rechargeable Thermal Sink (Ice Pack)
F – Dry Ice

		A	B	C	D	E	F
Weight (%)	**SELECTION CRITERIA**	**Rating**	**Rating**	**Rating**	**Rating**	**Rating**	**Rating**
16	**Adheres to WHO Standards**	5	5	2	2	4	3
14	**Inexpensive**	1	1	5	4	4	3
13	**Easy to use and maintain**	2	1	5	4	5	4
11	**Durable and Rugged**	4	4	3	3	5	4
14	**Portable and Modular**	2	2	3	3	5	4
10	**Self sustaining (wrt temperature)**	5	5	2	2	3	4
12	**Safe for user**	3	3	5	4	5	4
10	**Works with existing facilities**	3	3	4	3	5	4
100							
	SCORE	**3.08**	**2.95**	**3.62**	**3.13**	**4.5**	**3.7**
	RANK	**5**	**6**	**3**	**4**	**1**	**2**
	CONTINUE (Y/N)	**N**	**N**	**Y**	**N**	**Y**	**Y**

CONCEPTS (TEMPERATURE MONITORING AND CONTROL)

A – Temperature Sticker
B – External Monitoring System + LED Display
C – Electronic Temperature Sensor with Charging Station and USB Hookup with Alarm/Warning System
D – 2 piece Adhesive Temperature Sensor
E – Thermodynamic (Bi-Metallic Type) Temperature Sensor
F – Wireless Broadcast of Temperature Log
G – Temperature Sensitive Materials as Indicators (Temperature Sensitive)

		A	B	C	D	E	F	G
Weight (%)	**SELECTION CRITERIA**	**Rating**	**Rating**	**Rating**	**Rating**	**Rating**	**Rating**	**Rating**
18	**Adheres to WHO Standards/ Monitors Accurately**	3	4	5	2	4	3	3
16	**Inexpensive**	5	3	2	5	4	2	3
18	**Easy to use and maintain**	4	5	5	3	3	4	3
14	**Durable and Rugged**	2	5	4	3	3	4	3
12	**Compact**	5	4	3	4	3	3	4
14	**Efficient Warning Capability**	3	4	5	2	4	4	4
08	**Safe for user**	5	5	4	5	4	4	5
100								
	SCORE	**3.76**	**4.24**	**4.06**	**3.28**	**3.56**	**3.38**	**3.42**
	RANK	**3**	**1**	**2**	**7**	**4**	**6**	**5**
	CONTINUE (Y/N)	**Y**	**Y**	**Y**	**N**	**Y**	**N**	**N**

CONCEPT (PACKAGING/HANDLING)

A – Egg Crate Type Packaging
B – Ergonomic Box Design for Comfortable Carrying
C – Backpack containing Stack of Boxes
D – Adjustable System (Adaptive Straps) for Connecting Boxes
E – Partitioned Storage within Box
F – Rotary/other Individual Vial Dispensing Mechanism

		A	B	C	D	E	F
Weight (%)	**SELECTION CRITERIA**	**Rating**	**Rating**	**Rating**	**Rating**	**Rating**	**Rating**
18	**Does not interfere with Cold Chain Standards**	4	4	3	4	5	5
14	**Inexpensive**	5	3	3	4	3	3
16	**Easy to use and maintain**	4	4	4	5	4	5
14	**Durable and Rugged**	4	4	5	5	4	4
12	**Compact, Light Weight and Portable**	5	3	3	4	4	3
6	**Aesthetically Appealing**	3	5	4	3	3	3
10	**Safe**	4	5	3	4	4	4
10	**Works with existing facilities**	3	4	5	4	3	3
100							
	SCORE	**3.8**	**3.5**	**3.2**	**3.84**	**3.58**	**3.62**
	RANK	**2**	**5**	**6**	**1**	**4**	**3**
	CONTINUE (Y/N)	**Y**	**N**	**N**	**Y**	**Y**	**Y**

Our main focus will be on designing a vaccine carrier having an efficient and cheap temperature control and monitoring method, and which will be easy to carry for the user.

The following are the short-listed concepts to be explored further:

COOLING MECHANISM

- **Ice Packs**
- **Dry Ice**

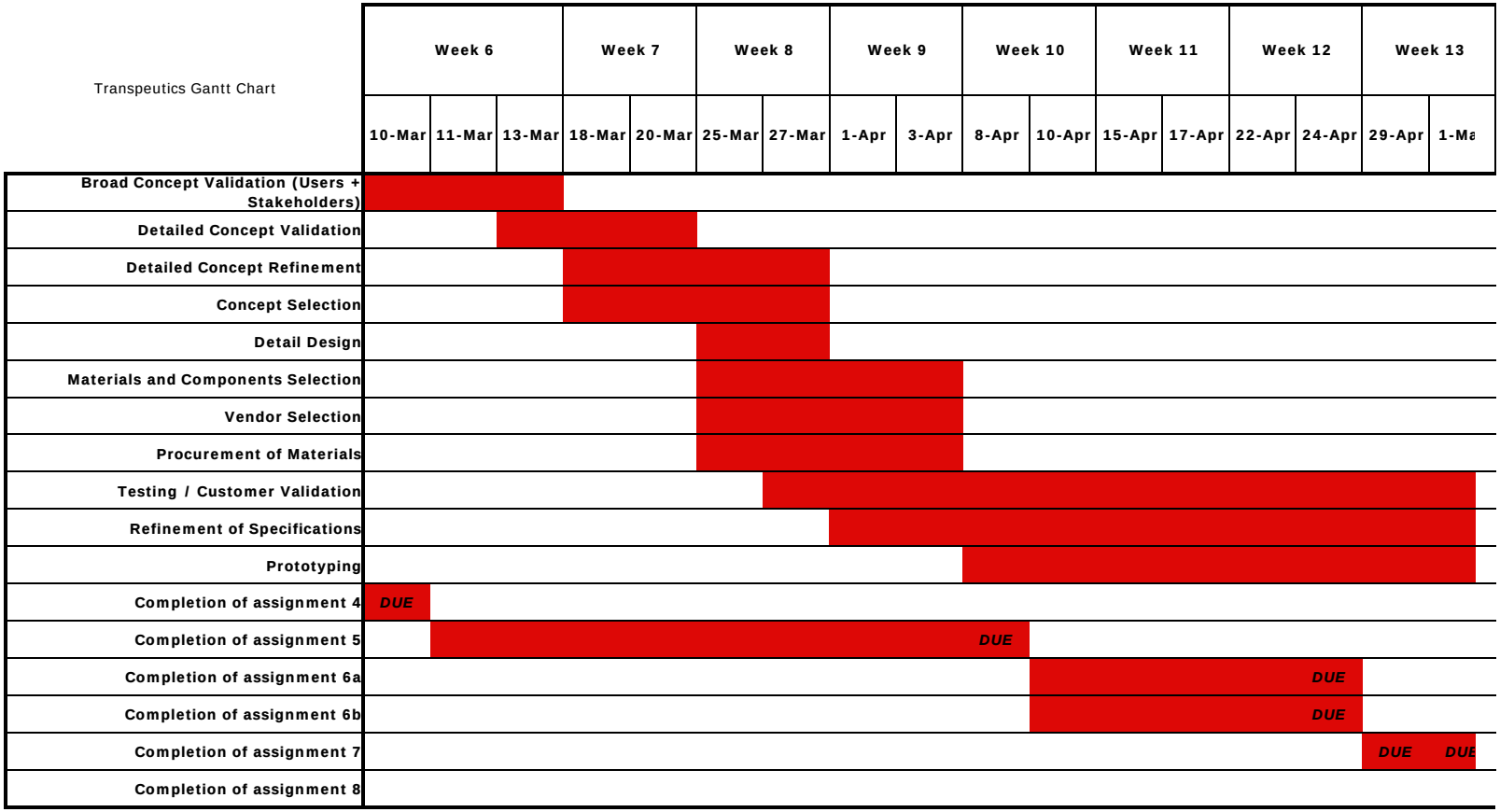
TEMPERATURE MONITORING AND CONTROL

- **Temperature Sticker**
- **LED Display**
- **Electronic Temperature Sensor (for expensive vaccines) with warning system**
- **Wireless Temperature Logging**

PACKAGING/HANDLING

- **Adaptive Straps for modular storage/carrying**
- **Egg-Crate type Packaging system for vaccines**
- **Partitioned Storage within the vaccine carrier**
- **Individual Vaccine Dispensing Mechanism (Rotary/Other)**

Transpeutics Gantt Chart



Key Uncertainties

1. Ability to produce at a low cost.
Action plan: perform a cost analysis of all materials and components once narrowed down, determine local availability of materials.

2. Egg crate design works far upstream, may cause a manufacturing delay to market.
Action plan: if design is pursued, determine all the parts of the supply chain that will be affected and resulting stakeholders' involvement needed, create a cost-benefit analysis of trade offs to decide on final design to pursue in light of this issue.

3. Which product concept will be feasible and meets the customers unmet need?
Action plan: share three preliminary concepts with stakeholders engage them to select the most promising idea.

4. Viability of implementation - will what we do work within the existing infrastructure?
Action plan: check with our supply-chain expert stakeholders at various stages of development with mock-ups and sketches to verify viability.

5. Can we innovate, but meet WHO standards so this can be purchased for field use?
Action plan: compare our specifications to published WHO standards, utilize their testing plan.

Process and Results

We met and reviewed the many product ideas we had generated. Then we had a group brainstorming session that involved creating sketch models and combining ideas, as well as generating new concepts that are part of our final three concepts. In addition, we also took our initial 15-20 product ideas, and scored them based on our needs list in order to check the feasibility and decide which should be part of our final three ideas. Now we have boiled it down to three main ideas, and we will validate and select the final concept based on further interviews with our expert users. We have been in contact with UNICEF, Doctors without Borders, professors from HSPH and Brown, and Management Sciences for Health.