Mechanical Engineering 110 | UGBA 190T

Introduction to Product Development
University of California, Berkeley

Professor Alice M. Agogino
Department of Mechanical Engineering
agogino@berkeley.edu

Professor Michael Borrus
Haas School of Business
mborrus@berkeley.edu

Samuel Cappoli | Shannon Chu | Akhil Devarakonda
Jimmy Huang | Daniella Seim | Evan Winger

1 Mission Statement

"To create an affordable and interactive tensegrity toy that generates interest in STEM fields through building and playing."

Our benefit proposition is to provide K-8 school children a fun and educational kit that will allow them to explore basic scientific concepts. The kit will provide them with an engaging activity that will teach them about current NASA research and how it is being applied to explore other planets. The kit will also help nurture a fascination for science in kids at an early age so that they pursue STEM related degrees in the future.

TENSOS' primary target market is the parents and educators of elementary school children. Our customers (the persons actually purchasing our product) will be parents or teachers. Our end users on the other hand are children for whom the product is purchased for. It was a special challenge tackling this dual nature and to create a product that would appeal to parents but also keep kids engaged. However, we have concluded that the simplicity of our product will suit this age group well since the instructions in the kit are clear and easy to follow and the process is active and engaging.

Our secondary target market include the parents of middle school children (up to 8th grade). The modularity of our product will allow this age group to go beyond the elementary school age group and explore other variations of the tensegrity structure.

The most important business goal we set out to achieve is being affordable. Based on market research, the price of a toy for this age group was found to be a significant deciding factor for customers. Sustainability is also a key business goal since we want our product to have minimal impact on the environment.

2 Customer and User Needs

Our customer needs were gathered primarily by background research, interviews, and prototype testing. Initially, we wanted to gain an understanding of similar existing products and their users. We collected marketing and pricing information about these products. We reasoned that this research would be invaluable when interviewing customers ourselves since it would give us a basic understanding of what our customers want.

Our interviews were primarily conducted at the Lawrence Hall of Science (LHS) in Berkeley, California. We conducted these interviews during a special event at the Hall in order to maximize the number of interviews we could perform. During our first visit to the hall, we conducted over around 46 interviews. We kept our questions broad to prevent biasing the responses we got from the people we interviewed. Some of the most important information gathered from these interviews were consolidated into our initial list of customer needs.

The team was constantly looking to revise and improve customer needs. After incorporating our customer needs to develop our first prototype, we showcased it at LHS. The prototype was a simple tensegrity structure that came with an instruction manual intended to help children build the model. We quickly discovered that using straws to construct the model would not be strong enough. Additionally, we realized that the instruction manual had to be further simplified since even adults were having trouble following it. After consolidating this information, we arrived at our final list of user needs, which dictate that our product is

1. active, entertaining, and engaging
2. promotes creativity
3. reasonably priced
4. durable and of high quality
5. easy to use and can be constructed with little parental guidance

3 Concept Generation

Based on our customer and user needs, we individually generated 20 or more concepts per team member, totalling 122 different concepts. Each concept was catalogued with a basic sketch, explanatory title, product description, list of features and attributes, and creativity methods (if any) used to generate the idea. Concepts were created with customer and user feedback and need statements in mind. For example, a statement like "the toy is an active experiment" led to concepts such as the Tensegrity Egg Drop Kit (Appendix I, Figure 6) and the Cereal Box Car (Figure 7). "The toy has a kinetic wow-factor" influenced concepts like the Tensegrity Rocket (Figure 8) and Tensegrity Bot Space Launchers (Figure 9).

While these need statements inspired and informed the concept brainstorming process, creative and wild ideas were highly encouraged, leading to a wide variety of unexpected and outside-the-box concepts. For example, the Giant Tensegrity Hamster Ball (Figure 10), Inflatable Boat Rover (Figure 11), and Tensegrity Fashion (Figure 12).

Creativity methods used to generate concepts included synthesis and inversion–for example, the Rocket Egg Drop (Figure 13) combined (synthesized) the features of the Tensegrity Egg Drop Kit and the Tensegrity Rocket, and the Pre-Tens (Figure 14) inverted traditional building toy design by coming pre-assembled, allowing the user to take apart and reconstruct the model. All 122 individual concepts were organized into five primary categories:

1. Kinetic, for concepts that rolled, vibrated, flew, or otherwise moved (45 total concepts)
2. Modular, for building kits or toys with additive, compatible pieces (15 total concepts)
3. Programmable, for robotic toys including programmable motion or

action (18 total concepts)

4. Stationary, for concepts with no built-in motion or action (26 total concepts)
5. Educational, for concepts focused on teaching about a specific scientific topic (18 total concepts)

While many concepts fit into multiple categories, each was placed into only one based on its primary functionality. With all concepts organized, we were able to narrow down and select which prototypes to focus on based on further analysis of how each product met customer and user needs, as described in the next section.

4 Concept Selection

Following the conclusion of early-stage interviews at the Lawrence Hall of Science and the subsequent assessment of user needs, formal methodologies were applied to the selection of concepts for prototyping. Initially, all concepts which were deemed roughly alike were merged into a couple designs, each incorporating the defining features of their constituent pieces. Additionally, all products deemed completely infeasible were removed from the selection process, bringing the total number of concepts pending selection down from 122, to roughly 20.

Out of the 20 surviving concepts, 17 were deemed unsatisfactory because they failed to meet at least one of the established user needs. The remaining three designs, Tensegrity Shapes, Tensegrity Servo, and Tensegrity Spine (Appendix II, Figure 15) were compared against a similar preexisting product, Tensegriteach, based on the following needs parameters: active/engaging or entertaining (30%); promotes creativity (15%); reasonable pricing (25%); durability (10%); and ease of use (20%). Weighting was based on feedback from potential users, nearly all of whom stated that science toys needed to be fun, competitively priced, and easy to use for both parents and children. A selection matrix was generated, with a rating for each concept based on how well they satisfied the selection criteria (Table 1). The ratings were weighted and then summed into individual scores, with higher scores being more desirable.

All three designs were selected for the midterm tradeshow, primarily due to the low variance among their concept selection scores – general feedback on more concepts was more important than focused feedback on a single concept. However, after aggregating comments and suggestions from the tradeshow, the team decided to merge all three concepts into one overarching design that satisfied all of the selection criteria more successfully than any individual design.

5 Use of Prototype Feedback

Once we had decided on our top three prototypes, we went to the Lawrence Hall of Science (LHS) to test them out on children and their parents, where we set up a booth for kids to make the various prototypes. We provided building instructions and materials including straws, rubber bands, tape, and scissors for the kids to use. Early on, we noticed that the instructions we provided were not easily understood. In addition, our materials were weak, and, as a result, people had difficulty completing the building process. Because of this, we often had to step in and help. Despite the pitfalls of having the kids attempt to build their own tensegrity, we received plenty of interest and excitement from both kids and parents regarding the prospect of a toy tensegrity.

Initially, we wanted to use low-cost materials such as straws and rubber bands to reduce production costs and create a more affordable toy, but from our experience at and feedback received from LHS, we agreed that the toy needed stronger materials to increase durability and ease the building process. Thus, instead of straws, we decided to use wooden dowels with slits cut into the tops and bottoms of each dowel, which would still be affordable and also sustainable. We kept rubber bands for the elastomer part of tensegrity because they are durable and affordable. To reinforce our product, we added end-caps, which would be used to cap the ends of each dowel once a tensegrity was completed, further maintaining durability.

At the midterm trade show, we received additional feedback that there was confusion as to whether our toy aimed for kids to learn facts about science or have them build something. This confusion was particularly focused on our spine tensegrity prototype, which we realized had more of an educational aspect and less appeal as a toy that could be played with for long-term periods. So, we decided to steer away from the idea of making our toy be a single tensegrity structure and focus on having a toy for kids to learn through building various kinds of tensegrity structures. Ultimately, from the feedback we received at LHS and the midterm trade show, we decided to create an affordable toy building kit, where a kid would have all the materials and instructions needed to make any tensegrity toy model, such as the 6-strut ball, tensegrity tower, and spine.

With our nearly complete prototype and instruction manual, we set up a booth on Cal Day for kids to build a tensegrity toy using our improved materials and kid-friendly instruction manual. Our goal was to have the kids build a tensegrity without any help from us, using only the instructions to guide them, as well as see if people were interested in buying our product. On occasion, we had to assist the kids in following the instructions and building the tensegrity, so we knew we had to further refine our instructions and decided to have online video instructions that would supplement the process. Our upgraded materials proved successful, as the kids were able to complete the building process with more ease and play with the finished product. There was overwhelmingly positive feedback from the kids and parents alike; kids eagerly worked together to build the tensegrity and actively played with the finished toy, running around the room and tossing it around. Parents were impressed by the learning through building aspect of the toy and how it connects to NASA. We received feedback from one parent who said that they enjoyed being able to build the structure with their child and learn about tensegrity – a bonding activity of sorts!

6 Design for the Environment

The ultimate goal of TENSOS is to create a sustainable product with minimal environmental impact, although material extraction, manufacturing, and transportation are likely sources of moderate impact. Manufacturing and transportation remain closely tied to available energy sources and were determined to be mostly out of reach and unchangeable while energy sources remain unchanged. As such, minimum material extraction and long product life cycles became the team's top priority.

During the initial design phase, many closed-loop use cycles were considered, including that of Strawbees, whereby components would be made of polypropylene and could be recycled and reused simply through melting and remolding. Ultimately, though, closed-loop systems based around petroleum products, regardless of usability, were deemed to be unsustainable, due to their inherently non-renewable nature.

Closed-loop use cycles have remained paramount as TENSOS' primary sustainability goal, especially when aided by outside recycling centers. Materials used in the kit, including packaging, instructions, and building components, are all easily recyclable and, depending on environmental impact, are either post-consumer or certified sustainable. The packaging is made entirely out of wood, and instead of using potentially harmful inks and dyes to color the box design, we opted to physically engrave our decorations using a laser cutter. In addition, the entire box is friction-fit, which eliminates the need to manufacture resource intensive metal hinges and connectors.

Additionally, it was determined that component materials should have low extraction impact. As such, wood is used extensively, and rubber is used in components traditionally made from petroleum products, including end caps. This maintains the kit's desired structural integrity while completely eliminating the major environmental impact associated with oil extraction.

Positive end-of-life systems were researched thoroughly in order to complete the product's closed loop use cycle. Ultimately, the team decided to implement a trade-in/refurbishment system, where users can return their TENSOS kits either in exchange for a deposit on another kit, and the returned kits are refurbished and resold. This means that the kits have a much lower environmental impact than other similar building kits.

7 Business Analysis

Our business model was developed with both profit and societal impact in mind. We want to be both financially successful and encourage interest in STEM fields. We plan to maximize the social impact of the kit by keeping the price as low as possible to afford all children access to the product.

7.1 Market

Our kit will be marketed towards parents, educators, and children. We anticipate that parents and educators will be purchasing the product but the kit is geared towards children, who are the users. We will do demonstrations with our product at science museums to generate interest and also work with school science programs to incorporate our kit into their curriculum.

Our primary retailers are expected to be major consumer outlets including Toys R Us, Target, Walmart, and Michaels. We will also sell in specialty stores such as museum stores. Our retailers will receive a 17% margin when we sell to them at a price of $10 so that they can in turn sell for around $12. We plan to also offer discounts (sell at a price of $10) for educators who wish to purchase directly from us in bulk.

Our market research estimates that we will sell 5,000 units in the first year and 50,000 in the second. Due to an increasing presence in retail stores and inclusion in science curriculums we expect a 2x growth per year with a cap at 400,000. Refer to the "Market Research" (10.3.1) section in the appendix for more information about our market research.

7.2 Financials

We combined market analysis and our product's mission together to come up with the best end user price of $12 per kit. We want to keep the price of the kit low to allow kids from all different economic levels to purchase and use our product while at the same time creating a financially successful company. Refer to Figure 17 in the appendix for the full financial analysis.

7.3 Fixed Costs

Our expected fixed costs are $60,000. We will have a product designer employed part-time ($25,000 annually) to create additional models and a sales and a part-time marketing position to place our products in the market. In addition we have $10,000 allocated to purchase and use the laser cutter to create the unique packaging. We will not need new machines since it is financially better to purchase the pieces of the kit from suppliers at an extremely low price.

7.4 Variable Costs

Our variable costs total \$5.63. Refer to Figure 16 in the appendix for a breakdown of the variable costs. The assembly of the kit requires non-technical labor. At \$10/hr with an assembly time of 60 kits/hr labor costs are low at \$0.17/unit. The material and labor overhead costs are 15%.

7.5 Analysis

We require a rate of return of 15% for our company. Our estimated variable costs may vary by 10% and our volume may vary by 20%. After running the Net Present Value Analysis our project appears financially attractive with an NPV of \$3,018,000. Our NPV remains positive when the sensitivity analysis is run to account for the variation in costs and volume. Refer to Figure 18 for Sensitivity and NPV Analysis.

8 Final Prototype

8.1 Packaging

The first thing any consumer sees when shopping is a product's packaging. With this in mind, our team wanted to create an attractive container for TENSOS that would leave a lasting first impression. In doing so, we created a kid-friendly design for the top and bottom cover of TENSOS' box. The box's geometry was first modeled in SolidWorks and then laser cut from stock wood. The design was subsequently engraved by the same machine. On the inside of the box are all parts of the building kit organized in their own compartments.

Figure 1: TENSOS Kit

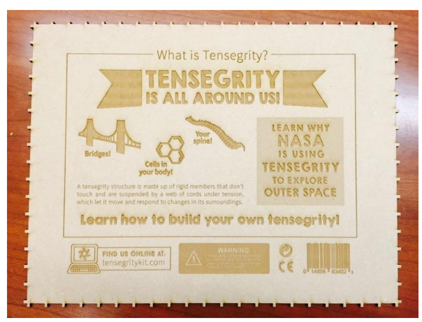


Figure 2: Kit box back piece

8.2 Instruction Booklet

The highlight of our kit is the instruction booklet. It is complete with full-colored and kid-friendly instructions on how to assemble various tensegrity models. The booklet also provides background information meant to inspire users including a section explaining what tensegrity is and how NASA is using the concept to build the next generation of planetary rovers.

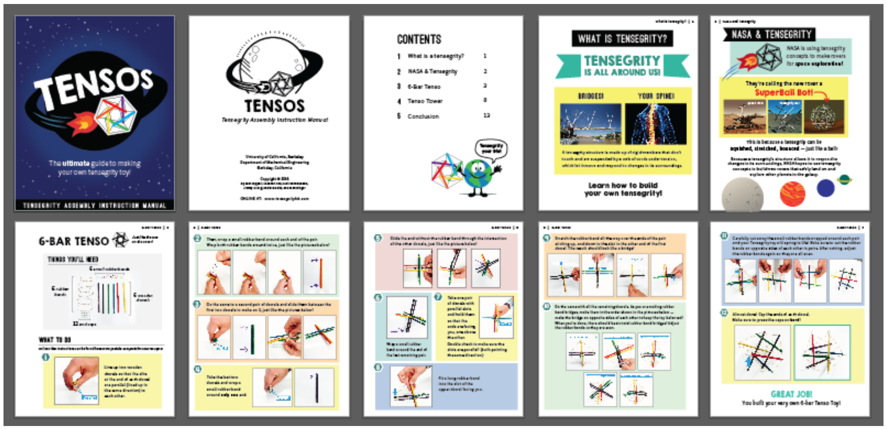


Figure 3: Pages from the instruction booklet

8.3 Website

Finally, we have developed a fully functioning website that provides a community surrounding TENSOS to bring kids together in their excitement for building and science. The website will act like a forum and create a community where children can share their designs with their friends or with other children from around the world. On the forum users can give feedback to each other and on one another's designs. The website also has step-by-step video instructions of the booklet already provided in the box. The website is currently live at:
http://jimmyhuang6.wix.com/nasa-tensegrity-kit

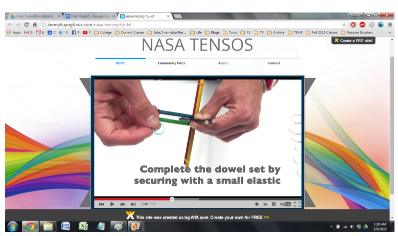


Figure 4: Instructional video on website

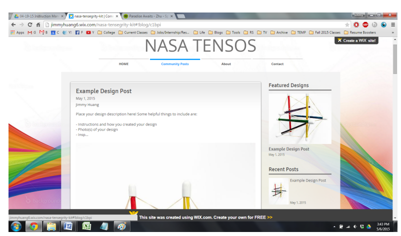


Figure 5: Building instructions on website

8.4 Value Proposition

If launched, TENSOS would stand out from the competition by bringing a NASA technology into the hands of children and inspiring them to pursue STEM topics. Specifically TENSOS would be the only building kit currently on the market that incorporates the concept of tensegrity, a cutting-edge NASA technology that is currently under development for planetary exploration. TENSOS also creates a community for children to expand their building and science knowledge with other excited kids.

9 Self-Reflection

TENSOS has taught our group valuable lessons about the product development process as well as working in diverse teams. In terms of the product development process itself, one key lesson was learning to listen to one another's input in the brainstorming process. No matter how ridiculous the idea may seem, it allowed other members to build upon that idea and be creative. During the customer interviews the team also learned the importance of immersing ourselves in the environment where users and ultimately where the product will be. This allowed us to pick up on small nuances that can help better the final product. When conducting interviews and performing field testing, we also learned to ask open ended questions. This is to ensure that we do not prime the potential customer with answers that are already expected.

In terms of team dynamics, we had team members from a variety of backgrounds including mechanical engineering, business administration, and cognitive science. We quickly learned that communication was key and that the team should communicate early and often to ensure tasks are properly delegated and that everyone is on the same page. This also meant that collaborative software such as GroupMe, Drive, and Google Docs were essential. Another lesson that became obvious was that everyone on the team had something unique to offer; group members eagerly volunteered to lead different aspects of the project. For example, Shannon had previous graphic design experience and was responsible for all of the projects visuals. Jimmy on the other hand had previous web development experience and set out to build a fully functioning website for our product. With all this said, the most important team dynamic lesson we learned was being able to have fun. Being able to joke with one another and talk about food somehow gave us the motivation and drive to complete our respective tasks.

10 Appendices

10.1 Appendix I: Concept Generation Examples

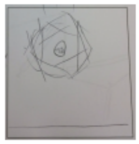
Tensegrity Egg Drop Kit		Kit with tensegrity toy components to make a tensegrity device that will save an egg from breaking when dropped from a height	Creative, constructible, experimental, reusable, cooperative, competitive

Figure 6: Tensegrity Egg Drop Kit initial concept, from Concept Generation table. Includes (from left to right) title, basic sketch, product description, and features/attributes.

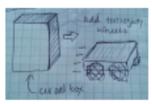
Cereal box car		Uses empty cereal box. Kids can make tensegrity wheels and attach them to the cereal box to make a vehicle. Can attach wheels in different areas to figure out best configuration.	Motion, engaging

Figure 7: Cereal Box Car initial concept.

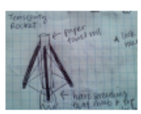
Tensegrity Rocket		Kids can learn how to build a rocket ship using a paper towel cardboard roll, tensegrity structures, and homemade items for the rocket power.	Wow factor, inspire interest in astronomy/physics, buildable, cheap

Figure 8: Tensegrity Rocket initial concept.

Tensegrity Bot Space Launchers		Tensegrity toy building kits with slingshot-type launchers to launch tensegrity bots	exciting, creative, competitive, fast-moving, constructible

Figure 9: Tensegrity Bot Space Launchers initial concept.

Giant tensegrity hamster ball		Giant tensegrity ball that user can step inside of and roll around in	big, active, exciting

Figure 10: Giant Tensegrity Hamster Ball initial concept.

Tensegrity Inflatable Boat Rover		Explore unknown waters in this inflatable Tensegrity flotation device with a seat in the middle for Flintstones-style paddling	waterproof, active

Figure 11: Tensegrity Inflatable Boat Rover initial concept.

Tensegrity Fashion		This is a kit where girls can build a purse to be a tensegrity structure.	Fashion, fun, educational

Figure 12: Tensegrity Fashion initial concept.

Rocket Egg Drop		Model/toy rocket engine for propulsion. Fins attached to vertices for stability. Rigid straws surrounding rubber band cores in a tetrahedral shape. Egg drop harness	Robust, flight, kinetic, science, educational	Synthesis: combining egg drop idea with rocket idea

Figure 13: Rocket Egg Drop initial concept, including creativity method on far left.

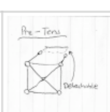
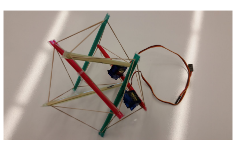
Pre-Tens		Pre-built tensegrity structure that is detachable. Challenges kids to rebuild it like a puzzle or to come up with a better design.	Modular, sturdy, simple	Inversion - building products rarely come pre-assembled. Appeals to the engineer that likes taking things apart and requires help putting things back together.

Figure 14: Pre-Tens initial concept.

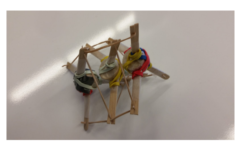
10.2 Appendix II: Concept Selection Supporting Material

Concept Selecton Matrix Deliverable T-8			A			B			C			D	
			(reference)										
	Segment		Tensegriteach			Tensegrity Shapes			Tensegrity Servo			Tensegrity Spine	
Selection Criteria (Customer Needs)	Weight (%)	Rating	Notes	Wtd	Rating	Notes	Wtd	Rating	Notes	Wtd	Rating	Notes	Wtd
The toy is active, entertaining and engaging.	30%	3	Interesting to compress different rigid struts and see how the whole object reacts to the added external force	0.90	4	Enguaging becasue of the different build paths	1.20	5	The toy has the ability to move around	1.50	2	May be engaging initially, but once constructed, the toy really only stretches and contracts	0.60
The toy promotes creativity	15%	2	There is only one (1) set of instructions and one (1) end product	0.30	4	More open-ended than Tensegriteach, but still limited	0.60	2	Allows user to place servos in various locations for different types of movement	0.30	2	Can only really string together more vertebrae	0.30
The toy is resonably priced	25%	4	Retail price is $24.99	1.00	5	Basic household materials such as straws and rubber bands	1.25	4	They toy would cost around $25	1.00	5	Has negligible cost increase over Tensegrity Shapes.	1.25
The toy is durable and high quality.	10%	4	Wooden dowels and caps with elastic bands	0.40	3	Wooden dowels and caps with elastic bands	0.30	4	The servos and other materials are durable	0.40	4	Wooden dowels, spheres, caps, and elastic bands are durable	0.40
The toy is easy to use and can be constucted with little parental guidance	20%	2	Would need parental guidence for ages below 10. Very easy for adults and young adults to construct though	0.40	2	Very difficult to construct with current prototyping materials. Higher fidelity versions will focus on ease of use.	0.40	4	Easy to construct since all that needs to be done is to place the servos in the proper locations	0.80	5	All vertebrae are constructed the same and are easily constructed and connected.	1.00
** The toy teaches about Tensegrity concepts is another salient need, but all concepts had the same score **		5	Clear tensegrity object with rigid bodies and elastomers	0.00	5	Clear tensegrity object with rigid bodies and elastomers	0.00	5	Clear tensegrity object with rigid bodies and elastomers	0.00	5	Clear tensegrity object with rigid bodies and elastomers	0.00
				0.00			0.00			0.00			0.00
				0.00			0.00			0.00			0.00
				0.00			0.00			0.00			0.00
	Total Score		3.00			3.75			4.00			3.55	
	Rank		4			2			1			3	
	Continue ?		Y			Y			Y			Y	

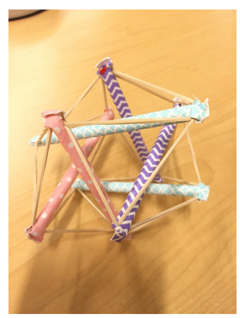
Table 1: Concept selection matrix.



(a) Tensegrity Servo



(b) Tensegrity Spine



(c) Tensegrity Shapes

Figure 15: Three Prototypes

10.3 Appendix III: Business Analysis

Type	Price	Units	Price/Unit	# of units in kit	Price/kit
Dowels	$208.80	3000	0.0696	20	1.392
End Caps	$69.00	5000	0.0138	40	0.552
Rubber bands	$5.00	1000	0.005	40	0.2
Small Elastic	$2.99	600	0.00498333	60	0.299
Packaging	$2.00	1	2	1	2
Booklet	$0.01	1	0.01	20	0.2
Total variable	$287.80	$9,602.00	$2.10	$181.00	$4.64

Figure 16: Cost Breakdown

10.3.1 Market Research

10.3.1.1 Market Size

- Building Sets
  - Worth $1.85 billion domestically (2014)
  - Annual domestic growth rate of 13% (2013-2014)
- Arts and Crafts
  - Worth $94 million domestically (2014)
  - Annual domestic growth rate of 3% (2013-2014)
- Population Trends
  - 4 - 11 year-olds living in US: 32,650,000 (2015)
  - Estimated percentage purchasing: 5%

10.3.1.2 Market Trends

Maker Movement:

Growth in maker movement leads to direct growth in the building set market and arts and crafts market. Tensegrity K-8 can be classified as either, and should benefit from timely introduction in a rapidly growing underserved market.

Open-Ended Playtime:

Tensegrity K-8 kits can be secondarily used in open-ended play. Given the low saturation of the market, currently, the kit would benefit from introduction and advertisement as such.

“Smart” Play:

Tensegrity K-8 kits directly teach about STEM concepts and are primarily aimed at educators and parents/younger students. The toy is innovative and sets itself apart from other more general, unfocused science kits.

(Information sourced from the Toy Industry Association, Inc.)

NASA Tensegrity Kit Financials

		Gross Margin	Sales Price
End-User Price	$ 12		
Company Sales Price (to reseller)		17%	$ 10

Calendar Year	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**TOTAL**
Expected Volumes	5,000	50,000	100,000	200,000	400,000	400,000	400,000	1,555,000
Company Actual Sales Price	$ 10	$ 10	$ 10	$ 10	$ 10	$ 10	$ 10	
FIXED COSTS								
(describe costs on separate page)	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**TOTAL**
- Product Design	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 350,000
- Tools/Molds (inj. molding, casting, etc.)	$ 10,000	$ 10,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 45,000
PRODUCT'S FIXED COSTS	$ 60,000	$ 60,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 395,000
VARIABLE COSTS / unit								
(describe costs on separate page)	**0**	**1**	**2**	**3**	**4**	**5**	**6**	
- Material	$ 4.64	$ 4.64	$ 4.64	$ 4.64	$ 4.64	$ 4.64	$ 4.64	
- Labor	$ 0.17	$ 0.17	$ 0.17	$ 0.17	$ 0.17	$ 0.17	$ 0.17	
- *Overhead %*								
Material OH 15%								
Labor OH 15%								

Figure 17: Kit Financials

	Best Case			Worst Case
VolumeError Settings:	0%	20%	0%	20%
CostError Settings:	0%	0%	10%	10%
RoR	**NPV-Best**	**NPV-Vol**	**NPV-Co**	**NPV-VolCo**
10%	$3,821,000	$3,001,000	$3,293,000	$2,579,000
15%	$3,018,000	$2,367,000	$2,599,000	$2,032,000
20%	$2,416,000	$1,891,000	$2,078,000	$1,621,000

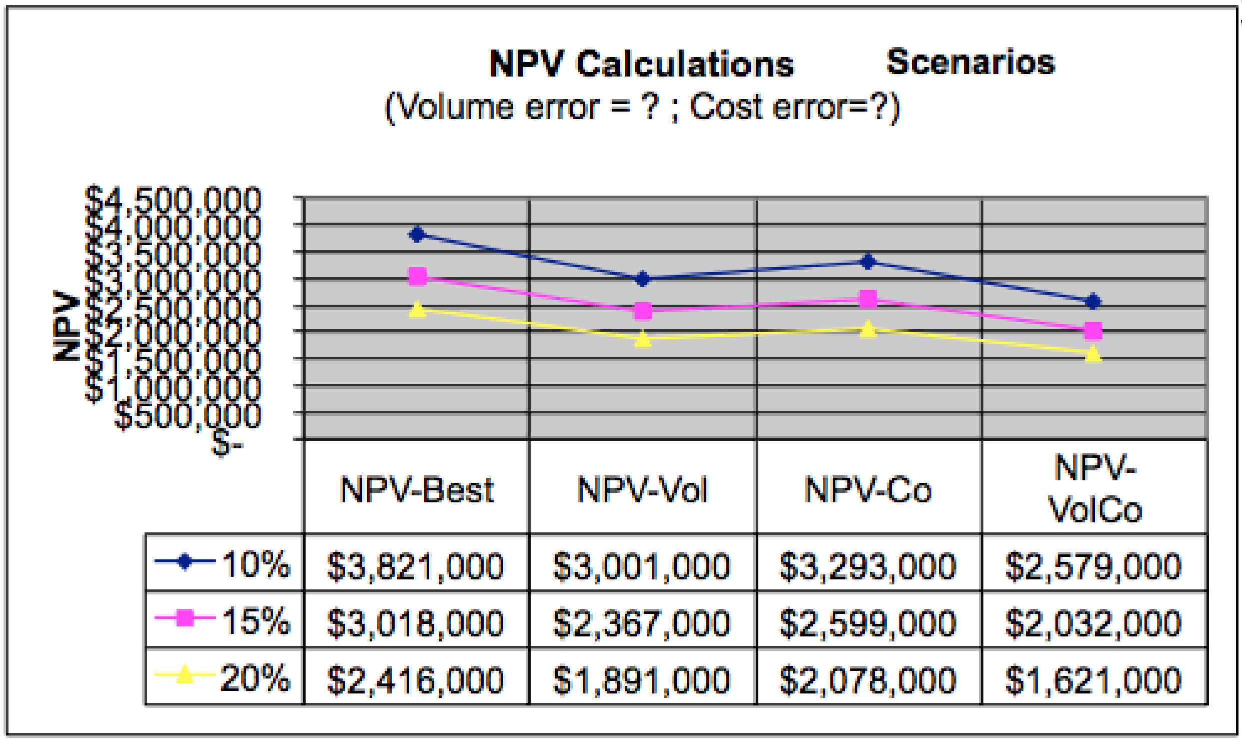


Figure 18: Net Present Value and Sensitivity Analysis

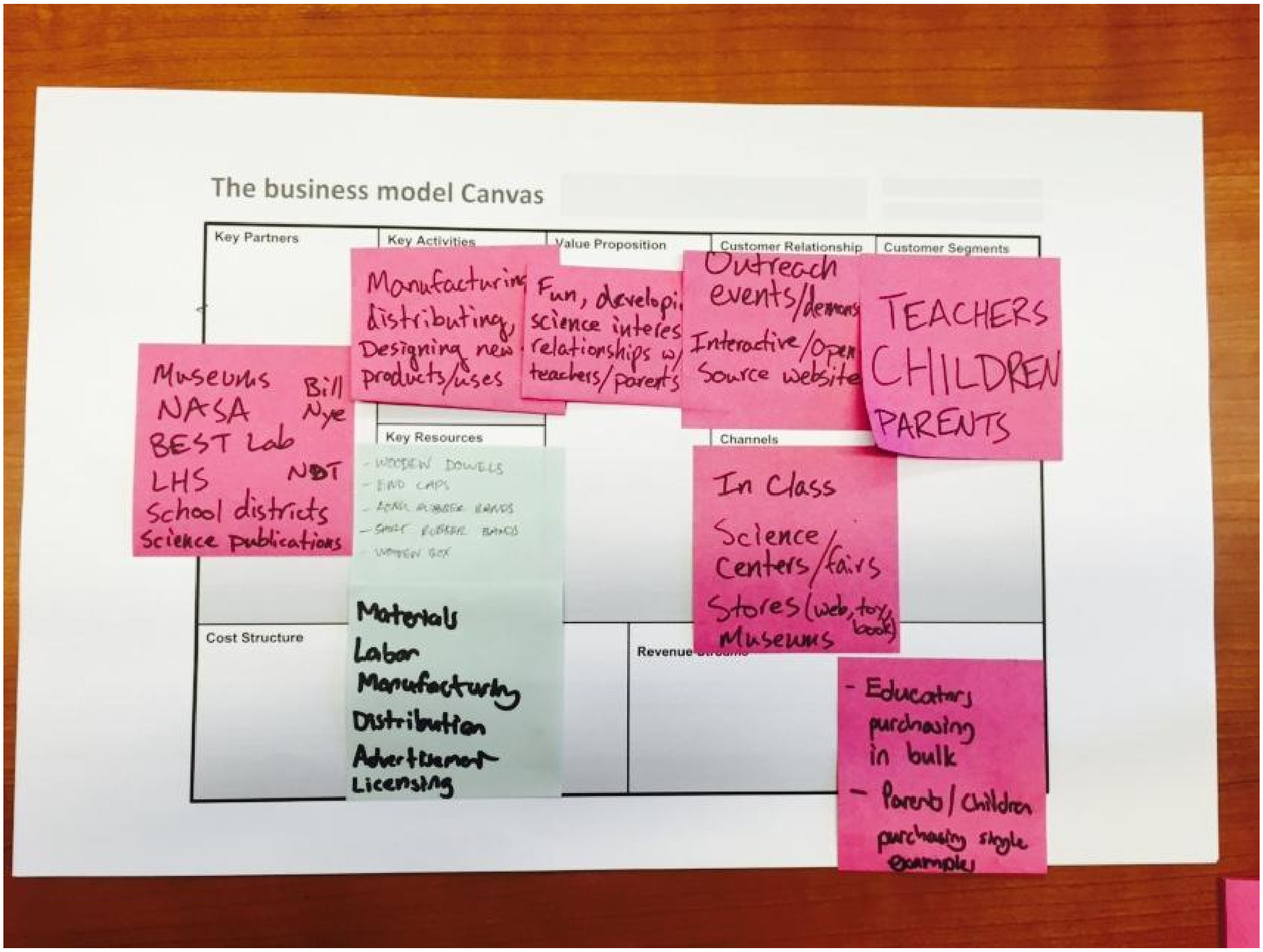


Figure 19: Business Model Canvas

10.4 Appendix IV: Final Prototype

Figure 20: Disassembled kit box

10.5 Appendix IV: Website

Figure 21: Cal Day video on website

Figure 22: Pictures on website

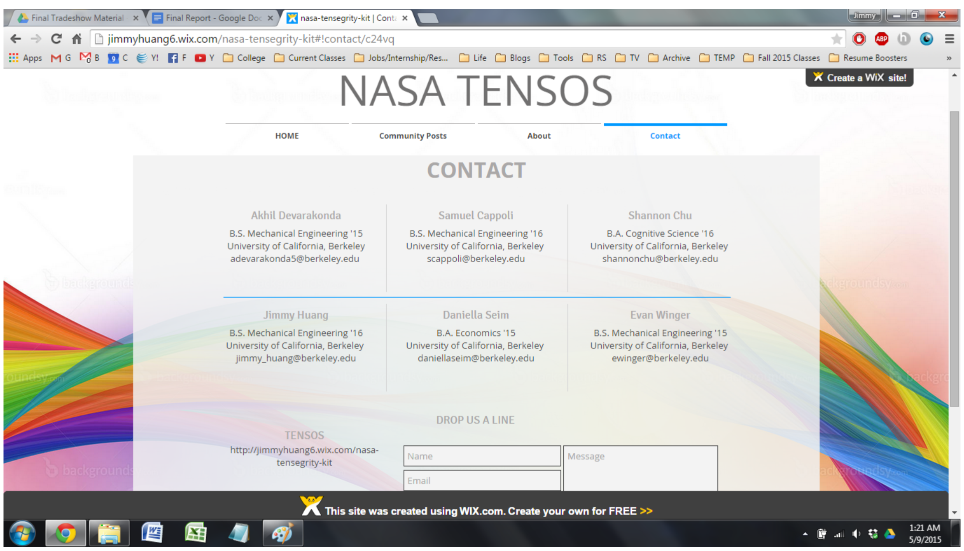


Figure 23: Team members page on website