BUSINESS PLAN FOR POLYMER COMPOSITE GASOLINE TANKS

Submitted by: Group 11

Lucio Boccacci
Jaime Erazo
Nick Harm
Zack McGill
Ryan Posey

April 30, 2004
University of Oklahoma

Summary

Our goal is to provide large automobile manufacturers with a safe, strong, recyclable, lightweight, affordable, and zero emission polymer composite gasoline tanks.

HEMIS manufactures polymer gas tanks that meet the necessary safety standards and exceed current emissions specifications to be installed into passenger automobiles. We intend to sell our gas tanks to large automobile manufacturers so that the tanks may be installed into cars during production. These manufacturers will purchase large numbers of our tanks because ours are superior to current tanks and a large demand for polymer tanks currently exists.

We are currently seeking investors to help our business develop and begin production. The initial investment will be used to create prototypes. Prototype tanks will be produced and used to approach potential customers and investors. Additional capital needs to be raised in order to begin full scale production. The following document outlines our business strategy and structure.

Project Summary

The design was carried out in several stages. The first stage was to examine current gasoline tanks and to investigate safety and emission regulations. Information on current gas tanks was obtained for several reasons. First, it served as a reference point for the project and provided ideas and opportunities to produce gas tanks superior to those currently in the market. The amount of competition for introducing a new tank was also needed. The safety and emission regulations were investigated and identified. The gas tank design had to meet or surpass all of the regulations in order for the tank to be suitable for use in consumer automobiles.

The second stage of the design procedure was to identify potential materials. The materials were identified based on their properties and feasibility for use in a gas tank. After identifying the potential materials, the mechanical properties of each potential material, as well as, the diffusion of gasoline through the material was examined. Diffusion and material strength are very important properties. These relate directly to the

determination of the gas tank wall thickness that would be needed to meet near-zero gas emissions and to produce a gas tank strong enough to meet the safety regulations. Once the diffusion and strength properties were determined, wall thickness can be determined for each applicable material and combinations may be produced if necessary.

The third stage was to identify processes that are capable of producing large numbers of gas tanks. After possible processes were found, they were matched with compatible materials. A total capital investment and return on investment was determined for each situation. Based on this return on investment, the most profitable process and material pair was chosen.

The final stage involves the evaluation of the risk and uncertainty associated with the process. This stage also includes the strategy that will be used to create the business plan.

Project Results Summary

After evaluating current gasoline tanks, safety regulations, and emissions standards, it was determined that a tank meeting near zero emissions standards must be produced in order to be competitive. Based on the diffusive and mechanical properties of the potential materials it was found that a multiple layer design was required to profitably meet both safety and emissions regulations. Stamping was found to be the optimal process using Curv® as a structural layer and ethylene vinyl alcohol as a barrier layer. The probability and risk associated with this venture are discussed later in this report.

Product Description

Our tank will be constructed of a polypropylene structure with an ethylene vinyl alcohol (EVOH) inner layer and a maleic anhydride adhesive layer. The polypropylene material used is Curv®. Curv® is produce by BP and is extremely strong and relatively inexpensive. The Curv® also gives our tank exceptional strength. The ethylene vinyl alcohol (EVOH) layer acts as a barrier keeping gasoline inside the tank. The EVOH allows our tank to meet the necessary emission specifications. The maleic anhydride allows the EVOH to adhere to the Curv® structure.

The tanks will be produced by stamping two separate halves and then attaching them to one another. Stamping involves placing the Curv® sheets into a high pressure stamp that forces the Curv® to take the desired shape. The Curv® is purchased with a thin film of maleic anhydride already attached to one side of the sheet. The maleic anhydride is then sprayed with a layer of EVOH. Next, another Curv®/maleic anhydride sheet is placed on top of the newly sprayed EVOH. The sheets enter the stamp, where they are pressed into the desired form. The tank halves are heated and riveted together. Finally, a thin layer of EVOH is sprayed on the seam to prevent the loss of gasoline through the seam.

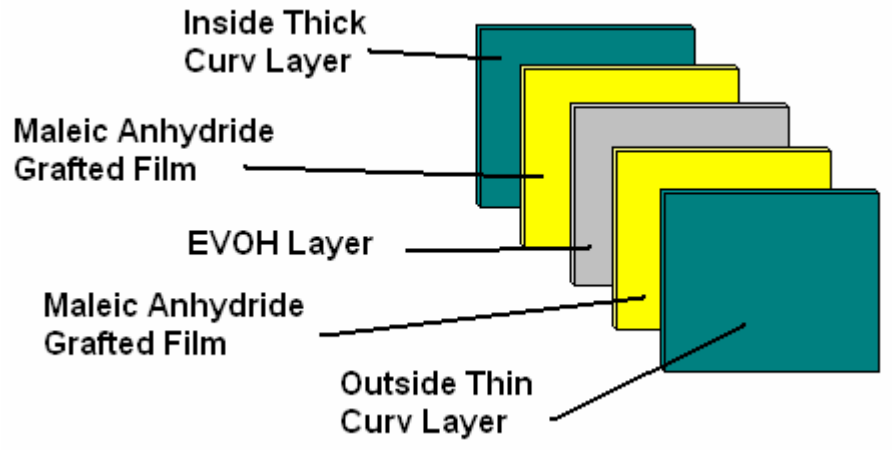


Figure 1: Tank Wall Structure

Market Analysis

There were 12.1 million automobiles produced in the United States in 2001. Of the 12.1 million passenger automobiles produced, 5.1 million were cars and 7 million were trucks and sport-utility vehicles. Of the 12.1 million automobiles that were produced, an estimated 70% were equipped with a plastic gas tank. The automobile industry has grown by 1% each year for the 3 previous years and is projected to continue to grow at this rate. Ford and General Motors are the leading automobile manufacturers in the U.S. Nissan and Honda also assemble large numbers of automobiles in the United States. Major assembly plants in the U.S. are located in Detroit, MI, Chicago, IL, Marysville, OH, Birmingham, AL, Jackson, MS.

Customer Profile

The customers that will be targeted by our business are major automobile manufacturers. The manufacturers that will be targeted initially will be manufacturers that produce large numbers of automobiles that are equipped with similar gasoline tanks. Our gas tanks will be sold to these manufacturers so that the tank may be installed in the automobiles during production. These manufacturers will consider both cost and quality when purchasing gasoline tanks. The price of the tank will affect the cost of manufacturing the automobile. The quality is also important to the automobile manufacturers. The gasoline tank must meet safety specifications in order to ensure the safety of the passengers inside the automobile in the event of an accident. The ability of our tanks to meet or exceed emissions standards is a government requirement, but is also a consideration for many potential customers. The end user of the automobile will benefit from purchasing a car equipped with a polymer gas tank due to increased fuel economy, but the tanks will not be sold directly to the public.

Competitive Analysis

The competition that will be faced in this venture will be the gas tank producers currently used by domestic automobile manufacturers. The competition has an established relationship with manufacturers and is selling a proven product. Our competition produces tanks from both steel and plastic. Both materials are safe for use in consumer automobiles. The steel is recyclable and allows very low emissions. The plastic tanks are lighter, cheaper, and less susceptible to vibration. However, the plastic used, cross-linked polyethylene, is not recyclable and allows more emissions than steel tanks. Some polymer tanks are constructed using multi-layer technology in order to reduce emissions, but the multi-layer technology cannot currently match the emission levels of steel tanks. Tanks constructed of both materials have been proven as acceptable for use in automobiles.

The risk associated with our polymer tank is that the material has not been used to produce gas tanks. Our tanks are cheaper, recyclable, and allow lower emissions than

current polymer gas tanks. However, the material is unproven in the automobile industry, and manufacturers may be reluctant to purchase our tanks. Another risk is that another gas tank manufacturer may develop a way to produce a cheaper or stronger tank.

One major manufacturer of polymer gas tanks is Visteon. They use a six layer tank design and produce them with a blow molding process. Since the tanks are sold directly to automobile manufacturers, the costs and sales prices are not publicly known. We modeled the blow molding process, using reasonable assumptions as to the logistics of their process and the specifics of their tank design, in order to estimate the price of a Visteon tank. The price of a Visteon tank was estimated to be $53.00. For this to be a profitable venture, producing tanks that are less expensive is one of our primary goals. Based on our model, we can sell our tanks for approximately $47.00 while maintaining a return on investment of greater than 15%. This price is based on a plant capacity of 500,000 tanks. If the interest is such that a plant with a larger capacity is necessary, the process becomes more profitable, allowing the selling price of our gas tank to decrease while still achieving the desired return on investment. The following table outlines the comparisons between our tank and the Visteon gas tank.

	HEMIS Tank	**Visteon Tank**
Price ($)	47.00	53.00
Weight (lb)	7.4	17.6
Recyclable	Yes	No

Strategy

Our key competitive capabilities are that we have the ability to produce tanks that are very lightweight, inexpensive, recyclable, and are safe for use in passenger automobiles. The process that is being used to produce the tanks is flexible and can be adjusted to make various shapes and sizes. The gas tanks can be customized to fit the specifications set by the customer. Our tanks are lighter than steel gas tanks, which increases fuel efficiency. They are also less expensive than metal and high density

polyethylene tanks which reduces the cost of automobile production. Our tanks are recyclable whereas current polymer gas tanks are not. The most important factor is that the tanks meet the safety and emission requirements.

The major weakness of our product is that it is a new technology. The material has not been used in automobiles before, while steel and high density polyethylene gas tanks have been in use for many years. Our analysis has strongly indicated that our polymer composite gas tanks can withstand the impact required by safety regulations.

Our strategy is to obtain contracts with major automobile manufacturers. Many automobile manufacturers produce several models with similar gas tanks. These manufacturers will be targeted first. Obtaining even one contract will give us entrance into the automobile manufacturing industry where our product can be proven.

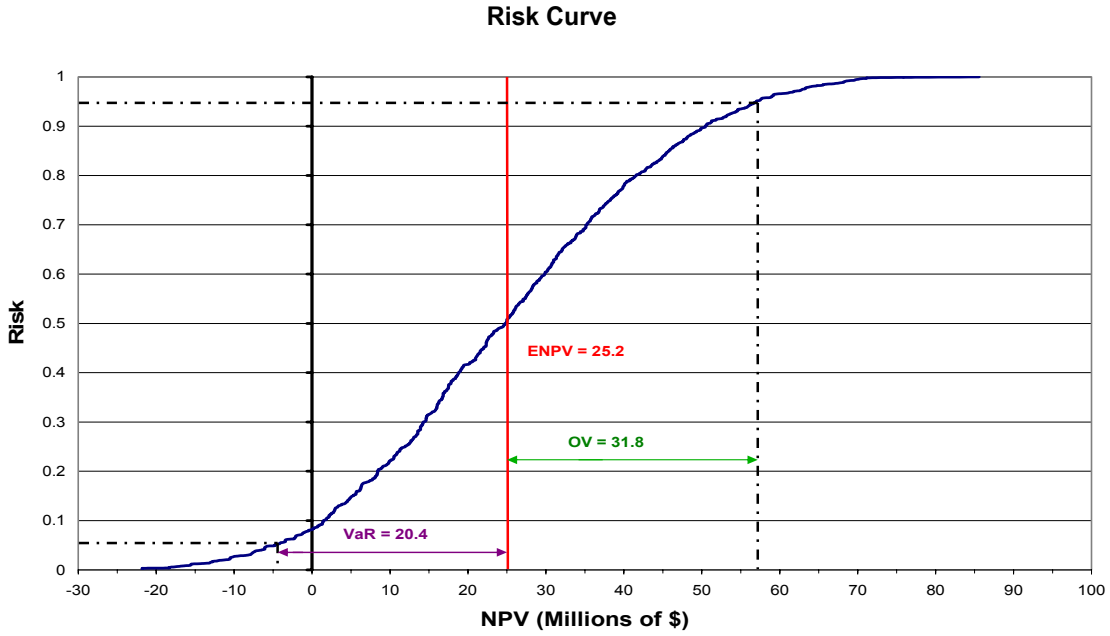
The first step in this strategy is to procure investment to build prototypes, perform necessary tests, and to gauge market interests. Once the necessary tests have been successfully completed and interested parties have been identified, additional investment will be sought. The additional investment will provide the necessary capital to construct production facilities, the amount of which will depend upon the interest expressed by potential customers. Near the end of plant construction, parties that have expressed interest will be contacted again with the intention of obtaining contracts.

Major car manufacturers such as General Motors, Nissan and Honda will be approached initially. GM sold 800,000 cars in 2003 that were all equipped with gas tanks with a 17 gallon capacity. GM sells the most tanks of a similar size of any single manufacturer and will thus be targeted first. Nissan sold approximately 300,000 cars with gas tanks that have a capacity of 17.2 gallons. Honda sold almost 300,000 cars that contain a gas tank with a 13.2 gallon capacity. The manufacturers that could potentially use our tanks are not limited to this list. Obtaining a contract with a manufacturer that produces a large number of automobiles with similar gas tanks would simplify production, lowering our production costs, and allowing us to offer our tanks at lower prices. If contracts are not obtained with these initially targeted companies, other manufacturers will be approached.

Profitability and Risk

The process was found to be both profitable and competitive. The sales price was calculated to maintain a minimum return on investment of 15 % while still undercutting the competition's price by $5.00 per tank. Based on a plant capacity of 500,000 tanks per year a total capital investment of $3.65 million is needed. The return on investment was found to be 15.8 % with a net present value of $3.53 million. The process becomes more profitable as the plant capacity increases.

The risk associated with this process was evaluated as follows. A Pert diagram was created to serve as a map for important project decisions. The first step in evaluating the risk was to determine the production numbers for various car makes and models. Based on the production numbers, prestige, and notoriety of the model, probabilities of obtaining interest in our tank were deduced for each model. Outcomes were generated by varying the interest level for the different models. The interest levels were used to estimate plant capacities, operating costs and revenues as well as the probabilities of obtaining contracts. After generating 1000 outcomes and calculating the net present value for each outcome the following risk curve was constructed.



The project was found to have only a 9% chance of losing money. The opportunity value is $31.8 million and the value at risk is $30.0 million. The expected net present value of this venture is $25.2 million.

Sales and Distribution

Our gas tanks will be sold directly to automobile manufacturers. An in-house sales team will deal directly with the manufacturers and handle all customer service. Since our tanks will be sold in large volumes and our tanks are relatively large items, they will be distributed to our customers via trucking and train. The method of transport will depend on the access the customer has to rail transport, the location of the customer, and the volume of the shipment. Initially, the tanks will be sold only in North America, and trucking and trains will be able to reach all customers. In the future overseas markets could be accessed. In the event that a customer located overseas purchases our tanks, they will be sent through ocean freight.

All trucking freight will be handled by J.B. Hunt. J.B. Hunt has been carrying freight for more than 20 years and guarantees more than 96% on-time delivery. J.B. Hunt operates throughout the entire lower 48 states and southern Canada. Rail freight services will be provided by Burlington Northern/Santa Fe. BNSF has a vast rail network with access to 28 states and 2 Canadian provinces. More importantly, BNSF services many of the markets where automobiles are assembled. Rail transport will be used when possible in order to decrease the shipping costs.

Management Description

Our management structure consists of one chief executive officer that oversees the operation of five main departments. Each department is controlled by a manager that reports to the chief executive officer. The five departments are quality control, process and manufacturing, public relations and sales, research and product design, and shipping and receiving. The basic management structure is located below.

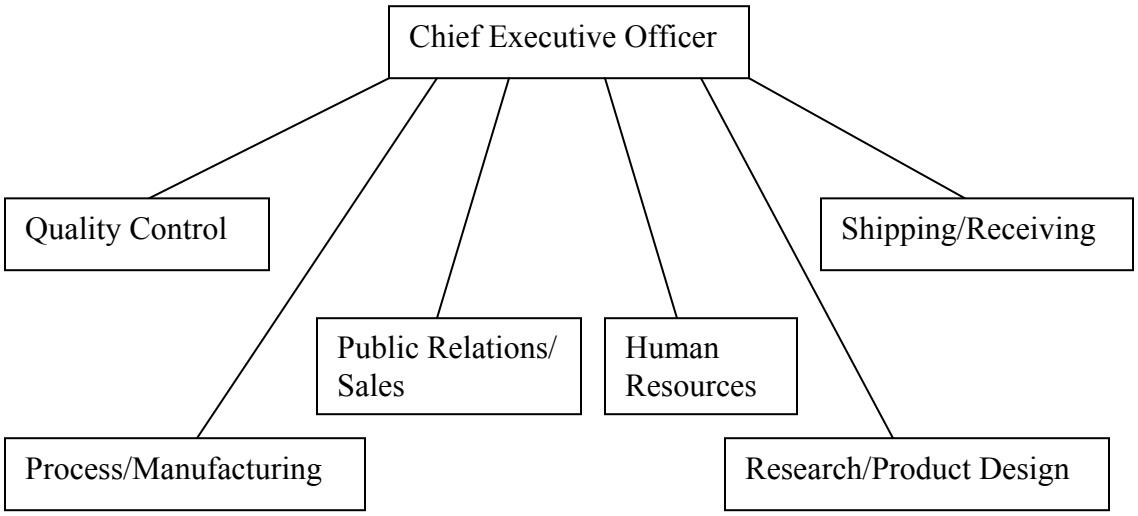


FIGURE A: Management Team

Chief Executive Officer

The chief executive officer will be the head and leader of the company. The CEO will be a person with strong leadership capabilities, business experience and management skills. This person would fill the role of manager, representative, and visionary. The CEO will make final decisions concerning marketing strategies. He will lead the management team, overseeing each manager and department.

Quality Control Manager

The quality control manager monitors the quality of the gas tanks throughout the manufacturing process. The quality control manager and his team examine the polymer composite matrix for purity and composition, examine the finished tanks for physical marks or defects, and carry out sample tests to ensure that the tanks being produced are meeting the necessary safety standards.

Process/Manufacturing Manager

The process/manufacturing manager is responsible for the manufacturing process from raw materials to finished tanks. He is responsible for addressing process concerns and managing manufacturing personnel. The process/manufacturing manager will also oversee the maintenance facilities and crews.

Public Relations/Sales Manager

The public relations/sales manager is responsible for managing the sales staff and developing marketing strategies. They will also handle contract negotiation and pricing. He would manage all customer services. The public relations/sales manager will coordinate the entire in-house sales staff. He will work closely with the process/manufacturing manager for order scheduling as well.

Research/Process Design Manager

The research/process design manager is responsible for developing advancements in product design. He and his team will search for new methods of manufacturing that will increase efficiency and lower production costs. The research/process design manager is also responsible for developing product advancements and improvements. The research/process design manager should be the leading expert on the capabilities and operating limits of the gas tanks.

Shipping/Receiving Manager

The shipping/receiving manager is responsible for all outgoing shipments and incoming materials. He also handles all product packaging.

Human Resources

The final piece of our management team is a human resources manager. This person will be responsible for much of the hiring. They will also address personnel scheduling. The human resources manager will oversee payroll practices and accounting.

The human resources manager will work closely with the public relations/sales manager considering accounts receivable.