An Assessment of the Emerging Business Model For Nanofilm's Anti-fog Product for Windshields

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Executive Summary

Nanofilm is one of the few profitable companies in the high-tech field of nanotechnology. Since 1985, they have developed and sold a variety of products pertaining to eyeglasses including anti-reflective coatings, scratch resistant coatings, UV coatings and anti-fog wipes.

With their success in applying nanotechnology to glass products, they have also developed Clarity Defender. This product is applied to the outside of a car's windshield to repel water, ice and animal stains. They are also producing an extended product of their Clarity Fog Eliminator for the inside of windshields. This is the product for discussion in this paper.

Nanofilm has made excellent inroads into the eyeglass field with their various products. Now their move into the totally unrelated field of automotive products means they will encounter different obstacles. The automotive products field is highly competitive, however, for the need Nanofilm is trying to meet, there is only one serious competitor. Rain-X has products that are targeted for both the inside and outside of the windshield. Their Rain-X product for the outside of the windshield has proven itself to be a quality product. The Rain-X anti-fog for the inside of the windshield has gotten very mixed reviews. The Rain-X anti-fog product only lasts about three months where the Clarity Fog Eliminator for windshields will last a year. This is where Nanofilm can produce a product that can compete against this well-known brand.

As mentioned, Nanofilm's move into the automotive products arena is going to be very difficult. It is dominated by big branding that requires serious marketing dollars to succeed. And that is where Rain-X stands. The product is manufactured by Pennzoil-Quaker State which is owned by the Shell Oil Company. Not only do they have deep pockets for marketing, but they also have quite a few successful products to build upon. This gives them power with after-market resellers for shelf space. For Nanofilm to try and overcome this by themselves would be extremely difficult and costly. Nanofilm needs to form a strategic alliance with a company that already has the complementary assets required to succeed in the automotive products field. One such product line identified is the Armor All suite of products. The Armor All line is owned by Clorox Company and thusly gives them substantial marketing power. Armor All also has the name recognition with a variety of high quality and successful automotive products. The line also doesn't have products to compete against the Rain-X windshield offerings. If Nanofilm can form this alliance (either with the Armor All line or another similar line), they will be able to offer their superior product, at a competitive cost, and take advantage of the marketing and distribution channels inherent with the right choice of strategic partner.

With 700,000,000 cars worldwide, growing at 30,000,000 each year, the market for a quality anti-fog product is substantial. With capturing only 5% of the targeted market share in 2006 to 40% in 2011 with a strategic partner and aggressive marketing, revenues ranging from about $3,000,000 in 2006 to $46,000,000 in 2011, can be realized.

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Introduction

Business Model Description

Nanofilm's potential business model builds on their success with their existing products. Their track record with their eyeglass lens protection and their anti-reflective treatment has enabled them to have their products on 1 of every 5 eyeglasses produced.[1] It has given them a significant market share in the eyeglass field. They have also developed a product that's an anti-fog compound for eyeglasses that has gotten very good reviews. Their knowledge of the interaction of their products with glass has allowed them to expand their product line to include a product that can be applied to the outside of a windshield to prohibit water and ice from sticking. It has the advantage over the market leader, Rain-X, by lasting for about a year where the Rain-X product lasts only about 3 months. And this is at a price that is about the same if not less than a year's worth of protection from Rain-X. Their next goal is to apply their knowledge of anti-fog protection to the larger surface of a windshield.

A key factor will of course be the effectiveness of the product to protect against fog formation. The leader in the field is also the maker of a Rain-X product for anti-fog protection. There is a lot of anecdotal evidence that the Rain-X anti-fog product is falling far short of the expectations levied by their original Rain-X product for the outside of the windshield.[2] When the original Rain-X first came out it was widely hailed as a very successful product and continues to be one of the premier coatings for the outside of automobile windows. So far, the Rain-X anti-fog product has been disappointing in its performance. This leaves a gap in meeting the need in the marketplace for a quality anti-fog product. The timing will be good for Nanofilm to come out with a product that meets this need, as long as it delivers the same high quality as their other products.

One of the obstacles Nanofilm will need to overcome is the entry into a highly competitive field, automotive products. This field is mostly dominated by big companies who have advertised heavily and have other successful products from which to leverage their influence. This is the case with the Rain-X products. Shell Oil company is the parent and the Rain-X products are manufactured by the Pennzoil-Quaker State company. They already have quite a variety of name brand products, with proven success, on the shelves of many stores. This is a high barrier to entry for Nanofilm to try and overcome. If they tried to compete head-to-head, they would incur very high marketing costs. They would also need to try and insert themselves into the right distribution channels to get their products into the hands of consumers. The most cost effective approach, and the one with the highest probability of success would be to form a strategic alliance with a company that has the complementary assets Nanofilm lacks. One choice would be the Armor All line of products. Armor All products are part of the STP company and is a wholly owned subsidiary of the Clorox company. This gives them the deep marketing pockets that will be required to launch a new product to compete with an established product. Armor All also has the brand recognition required to give the Nanofilm product some legitimacy in the automotive products field. Armor All also has the distribution channels required to get the product into the right places (major retail stores and automotive outlets) to get it into the hands of consumers. Another attractive aspect of partnering with Armor All would be that they do not currently have a product to compete with the two Rain-X products. Partnering with Nanofilm would expand the line of quality products Armor All would be offering their customers and would enhance the product line's reputation.

Overview of the Report

This paper analyzes the issues surrounding Nanofilm's release of their Clarity Fog Eliminator product for automotive windshields. An analysis is made of all the influencing factors inherent in their releasing of a product into a market they have very little experience with. The external assessment scopes out what the potential market is for not only Nanofilm's product, but for all anti-fog products. Assumptions are made about what Nanofilm can expect as a market share. Competitors are identified and they come from all directions. Porter's Five Forces are also evaluated (along with complementors) as well as the relevant opportunities and threats associated with the macro environment. Next, an internal assessment is made by looking into a variety of sources to gain a practical perspective on what Nanofilm's strengths are in the market. From the above information a strategic plan is drawn up that stresses the best approach for Nanofilm to take in the near and distant future. Financial projections are made based on broad assumptions as Nanofilm is a privately held company and insight into their internal finances was not possible. Revenues and costs were estimated based on data gathered from benchmark firms, both inside and outside the nanotechnology field. Finally several scenarios are drawn out to show potential sales.

External Assessment

Customer Analysis

Nanofilm's current customers encompass various segments, ranging from business-to-business targets to business-to-consumer sectors. Their value chain includes those commercial outlets that sell their products to various target market segments. As reported in the Nanofilm fact sheet, "Nanofilm views both consumers and businesses as partners. We create nanocoatings that can be consumer applied or applied easily within an OEM manufacturing facility."[3] The target market will be extended to include automotive product resellers, who would supply the Clarity Fog Eliminator.

The unmet need for anti-fog products complements their current windshield product, Clarity Defender, (for easier removal of ice, mud, bugs, tar and tree sap from windshields) and provides a viable market base for Nanofilm's invention. For the Clarity Defender product, the company's website boasts of increased driver vision of 34% on rainy nights, which can add about 1 second to driver response time. At 60 mph, that is an estimated 88 feet of pavement. Nanofilm's decision criterion extends from the motivation to improve existing glass treatment for their vehicle and increase safety conditions for drivers. A potential buyer decides to purchase Nanofilm's product for various reasons. Among them, their current window defogger's inoperability and inefficiency; climate induced purchasing decisions, where their geographical location has high humidity or excessive rain conditions; or the current anti-frog product being used does not satisfy their need. Other customers may not want to have to deal with their car's defogger, which may or may not perform very well. Other positive aspects of Nanofilm's product are the longevity of use versus competitor's product offerings and the value added safety benefits and anti-fog features for consumers. Nanofilm uses a differentiated product strategy and will sell for a competitive price. A noted competitive advantage of Nanofilm is their particular attention to expanding their product lineup to

include new product areas. This gives them a new set of customers, and thus a new market, for their products each time they can expand on their nanotechnology development and apply their expertise to another area.

Market Analysis

The potential niche for this type of product is tremendous, considering there are over 700 million automobiles in the world currently,[4] and it has been projected that the number will reach 1 billion by 2015.[5]

The potential overall target market for this product is any consumer who owns a vehicle. This includes not only vehicles whose installed defogger doesn't work, but also those individuals who don't want to deal with the defogger by applying anti-fog products. Naturally, there are areas of the United States (and the world) that experience different degrees of humidity, which would factor in the extent of marketing that would be done in that geographical region. For instance, minimal marketing may need to be done in Phoenix, Arizona, where more than half the year the average temperature is above 90 degrees, and often tops 100 degrees with little or no humidity. In contrast, an area such as Seattle, Washington may have extensive marketing done to attract the relatively significant anti-fog need there. In fact, different marketing programs would need to be created to capture all the different market segments.

This product is clearly in an introductory growth phase. The product was originally designed for use on eyeglasses, and it has been widely successful at preventing glass products from developing fog. The future growth rate of the Clarity Fog Eliminator product is dependent upon the various channels that Nanofilm decides to use to market the product. For instance, distribution through a retailer, such as an auto parts store, could potentially reap an extremely large customer base. But a strong marketing campaign would need to be implemented to attract the buyer in the first place. A second distribution channel Nanofilm would need to consider is online sales. This could be performed through retailers, or simply through their own marketing department. This form of marketing would enable the product to be purchased and distributed world wide, and repetitive sales would likely occur. A third form of marketing, which could be quite lucrative, would be a contract between Nanofilm and auto dealers, in which the product would be applied to new vehicles before delivery to the customer, and the product could be reapplied at specific time intervals in the future. This type of marketing plan could provide significant opportunities for Nanofilm. First, an estimated 60 million new automobiles are being produced annually.[6] Buyers of new vehicles often make their purchase decisions based more on emotional factors than financial or practical factors. This would benefit Nanofilm, as the customer would potentially connect new technology of anti-fog wipes with the new automobile they are purchasing. Additionally, a biannual or annual contract with the customer could ensure that the product has repetitive sales, thus providing a consistent inflow of revenue. Another potential market would be to appeal to technophiles with the lure of using a product infused with the latest in nanotechnology. An approach to get customers to try the new product could be the distribution of samples of the product with other products, such as the Armor All products, if they form a strategic alliance. They could also bundle the Clarity Defender product with the Clarity Fog Eliminator to provide a package to treat the inside as well as the outside of the vehicle windshield.

The market for this anti fog product will continue to grow. The number of new vehicles produced annually has continually increased, and as new channels of marketing are explored, the growth of the product will increase exponentially.

Competitor Analysis

Nanofilm's anti-fog product enters a market with a variety of competitors. However, none of the competitors proclaim that their product is based on nanotechnology. Therefore, it doesn't currently appear that there is a direct competitor's product as far as competing on a nano level.

The first and most prevalent competitor to the Clarity Fog Eliminator product is the installed base of defoggers on every single vehicle produced. There are two needs that can be met by anti-fog products. One is when the defogger simply doesn't do its job anymore. Fog accumulates and the installed defogger can't get rid of it. The second need would be for those who don't want to have to deal with fog buildup in the first place. They would apply an anti-fog product in order to not have to use their defogger, which even when it works, will often not completely clear the windows.

In the broader sense of anti-fog product competition, there are quite a number of products that reduce fog inside a vehicle, and there are several different approaches. Several strategic groups will be assessed. The first area is substitute products and they can be divided up into three strategic groups. They are liquid/cloth applications, film coverings and heated windshields. The fourth strategic group consists of the potential entrants.

In the first group, there are several products that are applied with either a spray or a cloth impregnated with an anti-fog solution. Most of the products are manufactured in the U.S. but at least one is produced and marketed only in Europe. A SWOT analysis of these products follows.

Spray/Cloth Anti-Fog Solutions

Strengths; • Successful product names in their region • Shelf space • Distribution channels • Automotive product experience • Successful product lines • Some large companies	Weaknesses; • Products don't perform well • Tarnished name brands due to poor performance • Limited geographic distribution
Opportunities; • R&D to improve product • Worldwide distribution	Threats; • Better performing products • Strong marketing

The second group is made up of products that are applied as a film to the inside of the windshield. There is not a large market for these applications except in the racecar field. The following is a SWOT analysis.

Anti-Fog Films

Strengths; • Strong performance on race cars • Gaining reputation	Weaknesses; • Must be professionally installed • Increased costs

• Lasts more than a year	• Longevity of film staying attached • Brand name
Opportunities; • Expand into mainstream automotive market • Build on current successes	Threats; • Cheaper products • Easier application • Less costly application

The third product group consists of several replacement windshield products. These companies have created a windshield that is heated from the inside.[7] Typical windshields are made with glass on the outside and glass on the inside with a sheet of plastic in the middle. This middle plastic has been replaced with a new proprietary coating that allows it to be heated. The main selling point for this product is its deicing properties, but the side benefit is of defogging as well. The SWOT perspective is below.

Heated Windshields

Strengths; • Permanent solution • Works well • De-ices as well as defogs	Weaknesses; • Cost of windshield • Repair costs • Replacement costs
Opportunities; • Market in colder climates • Install in new cars	Threats; • Cheaper products • Easy to apply products

The final grouping has to do with the potential entrants into the anti-fog for windshields field. Mostly they are products marketed toward either eyeglass cleaning, sports use or the safety industry. Each of these products market far more to the above uses than to windshield usage, if at all. Below is a SWOT assessment.

Potential Entrants - Spray/Cloth Anti-Fog Solutions

Strengths; • Brand name in their field • Good performance on small surfaces • Marketing in their niche	Weaknesses; • No branding of related products in automotive field • No distribution channels into automotive products
Opportunities; • Untapped market in automobiles	Threats; • Larger companies could move into their niche markets

Environmental Analysis

The attractiveness of Nanofilm's windshield anti-fog market is highly sensitive to buyer's bargaining power, and somewhat moderately sensitive to technology, societal and economic forces. Minor or low risk forces include substitutes, suppliers, potential entrants, global, demographic and government/legal/political. Competitors and complementary forces are primarily unknown risk factors at the present time.

Attractiveness of the Five Forces plus Complementors

Competitors

The attractiveness of Nanofilm introducing their anti-fog windshield product is there are currently no nanotechnology competitors in the market. Nanotechnology has been a breakthrough invention that allows substances and materials to be created and enhanced at the molecular level, thereby providing long lasting, strength and durability qualities. Substitute products that could directly compete are currently not adequately meeting customers' expectations, because of the lack of proper adherence to glass surfaces, application smearing and/or the ability to provide lasting benefits. These competitors also lack the knowledge and intellectual property to produce a superior product with the same long-lasting qualities expected with Nanofilm's Clarity Fog Eliminator.

One attractive aspect in the competitor force would be that Nanofilm could create a first-mover advantage over other anti-fog windshield products that do not possess the long-lasting qualities nanotechnology brings to anti-fog applications for windshields.

Buyers

Under normal circumstances, the average consumer doesn't seek out anti-fog windshield products, but would value the product, once introduced to its benefits. This type of product is something that would have to "personally appeal" to the customer to establish consistency in their normal buying habits. This would require some consumer education in the form of intensive marketing. Nanofilm can introduce this product to consumer buyers, but they need to look to long-term application and markets. Since Nanofilm doesn't have the superior distribution and marketing channels, they should pursue a strategic alliance or joint venture with a well-known brand company (e.g. Armor All) to aid in promoting their product.

The attractiveness of the market from the buyer perspective is that forming a strategic alliance with Armor All's strong marketing and distribution channels, could get Nanofilm's technology for anti-fog into the hands of the consumer more effectively. Additionally, there would be buyers that would purchase Armor All products for their brand-recognition, thereby, inducing purchases not originally made before. The potential market is equally attractive due to the shear size of available automobiles worldwide. Once the product is effectively introduced and proven in the market to meet anti-fog needs, repeat sales would be captured.

Suppliers

Specific supplier information to Nanofilm was unavailable due to their private company status. It is assumed that the primary supplied item for this product would be

the microfiber cloths required to apply the anti-fog substance to the windshield. This cloth must be of high quality to ensure the successful application of the nanoparticles with the cloth and transfer of these nanoparticles to the windshield by the consumer. Under a Forbes-recommended web-based supplier information base, Alibaba[8], there are literally thousands of global suppliers (e.g. Asia, China) available that manufacture and wholesale these cloths. Some well-known and quality domestic manufacturers of microfiber cloths include 3M, Erie Cotton (major supplier to Kimberly Clark), Casabella, and Vapor Clean Products. Attractiveness to Nanofilm, with regard to suppliers, is that there are many suppliers that could provide the quality microfiber cloth, at Nanofilm's quality requirements. This would reduce overall supplier bargaining power over Nanofilm, thus giving them the ability to further reduce variable costs of the primary supplied components.

The other components of the compound used to impregnate the application cloth are unknown due to the secretive nature of Nanofilm and their desire to protect their intellectual property.

Potential Entrants

Patents secured by Nanofilm would increase the barriers and temporarily block potential entrants from applying the same nanotechnology. For the long-term, it is recommended that Nanofilm move to try and develop a permanent anti-fog windshield technology, which would create a first-mover advantage, and could potentially lock-up vehicle and glass replacement manufacturers. There are a number of other potential entrants that are anti-fog product producers, but who at this time are only marketing their respective products in the sports, safety and/or industrial workplace markets. Nanofilm would also increase their power over potential entrants by forming a strategic alliance with the Clorox Company (Armor All products), thereby enabling them to strengthen their complementary asset position and give them a larger market base, with higher sales, thus potentially achieving economies of scale. They must make this strategic move early before their patents have expired and another potential entrant imitates their product or leapfrogs it with permanent windshield technology.

Substitutes

Substitutes include the current vehicle equipped car window defogger, the anti-fog windshield products mentioned above, and heated windshields. Substitutes are viable threats to the product introduced by Nanofilm. The heated windshield would be permanent solution but would come at a high initial cost. Reliability, repair and replacement costs could also be a concern for the new heated windshield product. The current vehicle window defogger usage will always be an issue but with proper marketing, individuals can be convinced it is too much hassle and can be replaced with an anti-fog application. Other anti-fog products could be bypassed by Nanofilm's long-lasting product that is easy to apply at a reasonable cost. The attractiveness from the substitute perspective is once the product is successfully introduced and proven to meet anti-fog needs, substitutes that can't match Nanofilm's superior long lasting qualities, would lose ground in the market. Additionally, since Nanofilm would keep their price comparable, switching costs from substitute products would not be prohibitive, thereby attracting consumer's desiring a long-lasting, quality product.

Complements

As a result of the research, there doesn't appear to be any direct complements to the anti-fog windshield product. There are two items that may not be direct complements, but are mentioned. With the current windshield substitute products, it is important to have a well-cleaned windshield surface for the anti-fog product to work in any varying level. Therefore, a possible complementary item would be those products, which clean windshields of all substances that would hinder application of the nanoparticles. This requirement would be reduced as the application process is improved to reduce adherence of the nanoparticles to less clean windshields.

Nanofilm introduced in early 2005, an outside windshield application, called Clarity Defender, which repels rain, ice, bugs, sticky substances and tar for up to a year. This could be considered an indirect complementary product for those individuals who would buy a variety of windshield products to enhance their vehicle experience.

Macro Environment

Demographic Forces

As mentioned, Nanofilm currently produces and markets the patented Clarity Fog Eliminator primarily for eyeglasses, but also for sport goggles, camera lenses, scopes, and masks (e.g. fireman, hockey, etc.). This, however, limits the anti-fog to markets where people use these products. Additionally, more individuals are investing in laser corrective eye surgery, which will put downward pressure on the market for eyewear in the future. Moving long-lasting anti-fog application to windshields will open market opportunities that should not be susceptible to these demographics.

Technology Forces

Any of the substitute products could become a stronger competitor by having a technological breakthrough. Even in the nanotechnology field another company could hit upon the right combinations to create a longer lasting or permanent anti-fog application. The initial and follow-on costs of a heated windshield could be a deterrent, but if costs could be reduced enough to make it a viable, affordable substitute, it would be even more competitive. Technology creates an opportunity for Nanofilm as long as they can continuously improve the long-lasting characteristic of their Clarity Fog Eliminator product, as well as be a first-mover into permanent anti-fog windshield applications.

Political/Legal/Regulatory Forces

U.S. Treasury Secretary John W. Snow traveled to Valley View, Ohio, to visit Nanofilm in July 2004 and witness demonstrations of Nanofilm's technology and products, including Clarity Fog Eliminator. According to Scott Rickett, Nanofilm president, "Nanofilm products take nanotechnology out of the lab and puts it into the mainstream."[9] His visit was to support President Bush's desire to promote jobs and boost the economy. This exposure, as well as the President's recent support and passage of the 21st Century Nanotechnology Research and Development Act, will have a profound political impact on Nanofilm's success in the near future. This bill, signed into law on December 16, 2003, allows for $3,678 million for federal research through 2007, some of which will come to Nanofilm. With the U.S. as the leader in nanotechnology, the act financially supports a program of government, university, industry, research and development and public involvement to further nanotechnology

pursuits. Five government entities will be authorized funding as follows: NSF, 47%; Department of Energy, 40%; NIST, 8%; NASA, 4% and EPA, 1%; with larger appropriations as benefits are realized. Additionally, there is approximately $5 million per year for a center to determine societal, ethical, educational, legal and workforce issues with regard to nanotechnology[10]. The downside to all this funding is that it could go to another nanotechnology company that could create a product to directly compete with Nanofilm's Clarity Fog Eliminator.

Nanofilm as a member of the NanoBusiness Alliance, a prominent U.S. nanotechnology advocate, visited top government officials in February 2005 to ensure that full federal funding and leadership is secured for future nanotechnology pursuits. Since nanotechnology is seen as a key component of future economic growth for the U.S., the alliance's primary reason for this tour was to ensure that authorizations under the 2003 Act are fully funded and supported. Some of the major issues to be discussed are pro-innovation regulatory strategy, nanotech breakthrough commercialization incentives, and priority for nanotech applications in national defense, such as environmental protection, life sciences, homeland security and electronic and information technology[11]. If these issues are fully supported by the government, this would provide benefits to Nanofilm via incentives for products produced and commercialized. It would also enhance the use of their products, such as anti-fog for defense and other government applications, thereby strengthening and enhancing Nanofilm's market base.

Nanofilm will continue their strong political, legal and regulatory stance for some time to come. This internal strength, with their numerous business alliances and connections, should open external opportunities in the future.

Societal Forces

Early in the biotech industry life cycle, concerns of health and dangerous environmental effects of genetically modified foods (GMF) were first raised, which eventually led to consumers rejecting GMF foods and meals. Nanotechnology will not escape their day in the spotlight, as well. According to Kristen Kulinowski of Rice University's Center for Biological and Environmental Nanotechnology, there has been very few, less than 50 studies, of scientific research initiatives on possible nanoparticle risk to human health and environment. This doesn't deter people like Pat R. Mooney, leader of the GMF scare, to point out probable risks to regulators in Washington and globally. His hope is to stifle new nanotechnology research until safety concerns can be addressed and public awareness is demonstrated. Although nanoparticles exist naturally without these risks, the concern is raised with manipulation of the particles and putting them in products and/or in environments where they don't naturally exist. Other concerns include health risks related to inhaling or ingesting these nanoparticles[12].

A recent federal report also addresses the extreme chemical reactivity of nanomaterials, which could be potentially toxic to workers exposed to particles during production. The same report states only a minimal risk to consumers. What is still unstudied and unknown is how these nanomaterials change over time and the effects of products that eventually are disposed as waste. The current regulations also don't address specific "bulk exposure", inherent with nanoparticles, and are currently regulated within chemical regulations. These "nano" regulations have been delayed due to adoption of an international standard, convention and naming system for nano-related technologies[13].

Whether these human and environment risks are founded and backed by scientific research, this ability to scare the masses and turn the public against

nanotechnology can be an extreme threat to Nanofilm's business model in the future. To reduce this risk, Nanofilm with the NanoBusiness Alliance introduced in July 2003, a task force to address health and environmental concerns with nanoparticles. Other members of the task force include Lockheed Martin and the EPA. Their idea is to counteract the "Mooneys" that will continue to threaten ongoing research of nanotechnology and introduction of nano-products into the market. The intent is to have a forum for sharing research and providing sound explanation of public nanotechnology concerns or issues. This task force is also looking at commissioning their own independent studies at Rice University and initiating standards for production and disposal of nano-products and waste. Additionally, a public website was formalized in September 2003.[14]

Globalization/International Forces

For the time being the U.S. is still leading the global nanotechnology race by producing more investment, patents (Americans hold 2/3 of all patents) and scientific papers (over 50% published) than any other country. In a recent report conducted by the federal government, though, Europe and Asia are quickly closing the gap. Although the U.S. leads with federal investment at $1 billion in 2004, Japan, China and Europe followed closely spending each about $900 million. Health concerns and public awareness are also paramount to countries such as Norway, Sweden, etc. They are investing in much more robust health and public awareness/involvement initiatives than is currently being done in the U.S.[15]

Global nanotechnology standardization including conventions and naming systems still needs to be developed. The idea is that to ensure successful globalization within the market, everyone needs to be on the "same page" and have standard regulatory and scientific regimes.[16]

Nanofilm will benefit by this lag in "nano" globalization, and their first-mover advantage. Unfortunately, global forces may eventually catch up with the U.S.'s lead in nanotechnology. Nanofilm must be aware of this global threat and plan for possible blocking strategies. Nanofilm has taken steps to be a global force by their international expansion and distribution within Europe, South America and the Pacific Rim.[17]

Economic Forces

Since this product is not a necessity, consumers would probably reduce consumption of this product when their disposable income is reduced during poor economic times. It is important that Nanofilm retain a growing global perspective, to ensure they can absorb those low sales volumes and demand during markets with low economic periods.

Internal Assessment

Core Competencies

One of the best examples of Nanofilm's core competency is their understanding of strategically important aspects of the nanotechnology arena. Nanofilm focuses on uncovering problems, the market needs, and develops solutions for those needs. They enable the use of nanotechnology to develop solutions that will improve life. According

to an article by Barnaby Feder, “Nanotechnology ... has attracted investment not only from privately held start-ups, but also from giants like I.B.M., General Electric and Dupont, which are eager to exploit the potentially valuable properties of materials so small that their dimensions can be measured in molecules.”[18] He goes on to report that the federal government estimates that nanotechnology, a catch-all label for products and processes that operate on the molecular scale, will have a $1 trillion economic impact by 2015. Nanofilm has the human resources in place to support current and future strategies exemplified by their growth from 17 employees in 1991 to 65 employees today.

Research and development continues to be the backbone of the company. As stated on the Nanofilm website, the company’s aim is to become a leading supplier of high-performance coatings for eyewear lenses and the leading producer of a full line of lens coatings and surface care cleansers.[19] Nanofilm’s core competency is derived from its development of commercial applications for its proprietary technology. Nanofilm promotes its technology as the standard for developing and commercializing revolutionary methods for forming ultra-thin coatings for a variety of applications, such as the automotive market. With an in-house team of Ph.D. chemists, the company continues to leverage its rich technological strengths to capture growth opportunities in optics, electronics and transparent barriers.

A noted core competency is that they are operating in ways that allow a small company to punch above its weight and stay at the forefront of developments in what is a rapidly changing technological environment. Nanofilm continues to develop innovations that have wide impact. As an example, the Clarity Defender product has been successful and is evidence that their research is of critical importance to the understanding of nanotechnology and its usefulness in the automotive environment. With its core competencies in R&D, Nanofilm is well positioned to serve companies and technology driven entrepreneurs in the emerging field of nanotechnology. The company provides industries with novel solutions through its core competencies in design system integration, and cutting edge thin-film coating processes. Nanofilm’s reputation has gained increased momentum as being successful in improving product features, reliability, and developing technological breakthroughs.

Intellectual property has emerged as one of the key corporate assets of the 21st century. If legal rights such as trademarks and patents were not available, the huge investments necessary to set a company apart through its brands or innovations – two fundamental requirements for success in today’s markets – would not be justifiable. Companies such as Nanofilm, which are driven by technology, appreciate just how valuable patent rights can be if they are properly understood, managed and exploited. Nanofilm is strategically positioned to realize value from their nanotechnology patents through licensing or partnering opportunities. This leads to yet another core competency of the brand positioning Nanofilm enjoys. Nanofilm is actively promoting brand development to form a lasting perception of the company within the minds of consumers.

Analysis of the First-Mover Advantage

Nanofilm will enjoy a first mover advantage by virtue of being the first company to introduce a nanotechnology product in the auto market. This will allow them to continuously build their brand and develop a loyal following that would entice customers to keep buying its product. Once established, this relationship can perhaps lead to multi-line selling and strategic alliances with firms providing complementary assets. The active compound in the material needed to produce anti-streaking and fog windshield

coating, are among the resources that are valuable, rare, and difficult to imitate or substitute, thus allowing immense potential for Nanofilm to collect huge profits before its patent expires. The proprietary formula leaves an ultra-thin, invisible film on optics that absorbs moisture and disperses it across the surface of the film, preventing fog formation.[20]

Small companies like Nanofilm, exploiting different niches, definitely position themselves well by competing in a healthy, growing industry with a strategy based on strengths that are unlikely to be acquired or neutralized by its competitors.

Complementary Assets

Nanofilm's complementary assets are lacking when targeting the automotive product market. They have done well to produce a quality product, but for it to be competitive, they will need much stronger distribution and marketing efforts to reach the automotive customers. They also lack the necessary brand name that would help them in selling their products and they don't have the relationships they need with retailers to get the shelf space they need.

Scope of the Business System and Outsourcing

Strategic alliances with big businesses pose inherent dangers for small companies like Nanofilm, but they recognize that they will need such relationships to turn new technology into profits. In Feder's article, Rickert speaks of Nanofilm's perspective regarding outsourcing. Rickert says, "we sell very small quantities of our materials at high prices. I can do it anywhere in the world with just a few people."[21] Moreover, Nanofilm has become a multinational with a small sales and distribution outpost in the Netherlands. However, Nanofilm realizes the challenge that lies ahead in regards to outsourcing various components of its production of its auto market products. A 2004 study by Lux Research found that many of the 200 global suppliers of basic nanomaterials failed to deliver what they promised. "As a group they have a frighteningly poor track record", says Lux Vice-President Matthew Nordon.[22] The article goes on to state that until the industry puts a qualified supply chain in place, only innovators working with world-class labs can count on reliable material. Ultimately, this will limit nanotechnology and hurt its growth.

Nanofilm has experienced the negative aspects of outsourcing first hand. Business Week article, "Bashful vs. Brash in the New Field of Nanotech" discloses an outsourcing nightmare for Nanofilm. He reports that Dr. Ricker's reliance on his relationship with Lens Crafters backfired in 1991 when the Persian Gulf War broke out, the economy slumped and Lens Crafters decided to shut its manufacturing in favor of outsourcing its production. As a result, there is an understandable reservation as outsourcing creates a world where losses often occur at the top rather than the bottom of the pyramid. As a result of the Lens Crafters fiasco, Nanofilm shrank from 17 employees to 5. Dr. Rickert eliminated his salary and the other employees were cut to 65 percent. The lesson learned was highlighted in an IndustryWeek article where Rickert is quoted as saying, "It's hard to make money saving manufacturing firms money. It is easy to make money helping them create unique product categories. And that was a hard lesson. They [always] think about saving money first – then they think about new products."[23] He goes on to discuss his determination to propel his marketing

approach into automotive and electronics by creating new categories that redefine the purpose and benefits of devices.

Success for companies and other institutions involved in nanotechnology research and commercialization requires access to skilled labor and specialized facilities and equipment. The Business Week article "High IPO hurdles for Nanotechs" reveals Nanofilm's strategic location in Northeastern Ohio, "Polymer-Valley". A unique strength reflected in the "Polymer Valley" area is that it is uniquely organized and geographically located in the proximity of big tire manufacturers Goodyear and Firestone, paint giants Sherwin-Williams, and a number of auto-parts makers are based in the area, which affords a rare expertise in materials research. Therefore, it makes more sense for Nanofilm to remain an Ohio-based company, rather than moving to Silicon Valley as most nano-companies.[24] Developing strategic alliances with these businesses will allow Nanofilm to maximize the inherent strengths of the region, and for the growth of automotive nanotechnology in the region.

Strategy Analysis

Situation Assessment

A SWOT analysis of Nanofilm reveals the strengths and weaknesses of the company, as well as their opportunities and threats.

Strengths:

- Cutting edge technology. Nano is currently a popular buzz word, and it is a huge strength that Nanofilm is already successful in the nano industry with real products available and strong revenues.
- Multiple patents (37), which will allow the company to become a leader in the nanotechnology field.
- Proven R&D expertise in nanotechnology.
- Global expansion and distribution within Europe, South America and the Pacific Rim.
- Active role in the NanoBusiness Alliance, creating a strong political, legal and regulatory stance.
- Product is unique in that it does not contain liquid, therefore no smearing.

Weaknesses:

- Lack of customer knowledge may prevent full appreciation of nanotechnology.
- Most customers have never heard of the company Nanofilm.
- Company success to date may categorize them in the eyeglass industry only, according to customers.
- Mediocre marketing and distribution channels in the automotive products area.

Opportunities:

- Millions of new cars are built every year, adding to the hundreds of millions existing already.

- Various forms of distribution exist, from traditional retail brick and mortar, to online from vendors and corporate website, to auto dealers.
- Current anti-fog products are underperforming expectations.

Threats:

- Every automobile has a substitute for Clarity Fog Eliminator already, the windshield defroster.
- Heated windshields for cars, if ever standard on automobiles, would eliminate the need for the product.
- New companies could market products as nanotechnology develops.
- Another company could introduce a permanent coating for the inside of windshields that provides the same results permanently.

Strategy Analysis

Nanofilm's traditional strategy with the Clarity Fog Eliminator has been to market the product through traditional brick and mortar retail outlets and online through their corporate website as well as online retailers, such as amazon.com. One issue that may arise from their traditional marketing approach is the lack of customer knowledge of the product and the company Nanofilm itself. In the past, Nanofilm has marketed their technology to other companies for improving their eyeglass products. The general public has not been exposed to the Nanofilm brand name; they have only noticed that their eyeglasses functioned better by having a lens that is more clear and scratch resistant. Nanofilm's competitors have an advantage in the fact that the general public has been exposed to the competitor's brand names. These include Rain-X and the Fuller Brush Company.

A strategy Nanofilm should consider is partnering with a company widely known for automotive products. Ideally, this company would not currently have a glass treatment in their product lineup. One company that Nanofilm should consider partnering with is Armor All Products Corporation. Currently, Armor All produces a line of products that conditions various parts of an automobile, such as the interior, tires and paint. The company brand name is widely known among automotive enthusiasts, and Armor All products can be found in most retail outlets, from automotive specialty shops to Wal-Mart. The only glass product Armor All currently markets is a window cleaner, similar to Windex.

A partnership would also benefit Armor All, as it would provide them with a product to enter another market segment, in this case a window treatment to prevent fog. Second, Nanofilm would be able to market their product with very little if any variable cost. Armor All could provide the cloth wipes, the distribution channels and the needed marketing, and Nanofilm could provide the anti-fogging nanotechnology. Armor All would benefit because the company would not need to invest heavily in R&D to develop the product. Lastly, Nanofilm would benefit from Armor All's brand name reputation.

Strategic Plan

Superior customer value can be delivered through a product that is easy to apply, long lasting, cost effective and easy to obtain by being in the stores where consumers shop. To offer such a product to customers, it would most easily be done through a

partnership, such as with Armor All. First, a product must be high quality for customers to find value in it. A product of low quality will not perpetuate value to the customer, and therefore repetitive purchasing will not occur. Second, the product must have long lasting qualities. A product that needs to be constantly reapplied will not be as valuable to a customer as one that lasts for an extended period of time. Although a long lasting product may not generate revenue from frequent repurchasing, customers may become very loyal to the product and recommend it highly to others. Third, the product must be cost competitive with other current and potential competitors to continue to provide the customer with value. Lastly, a product must be easy to obtain. This would be a key component to partnering with Armor All. Armor All's distribution network to a variety of outlets would enable Nanofilm to provide the customer their product whether it be an automotive specialty shop or a retail store. In addition, Armor All could bundle the anti-fog product with their other products for a complete auto kit to consumers.

Financial Projections

Estimates of Annual Revenues

Nanofilm is currently a privately held company, and financial data for this project was impossible to access. Company public statements have indicated that their revenues saw "double-digit" growth for 2002-03, with over $20 million in 2004. Nanofilm has primarily captured the optical market with 70% of the top 25 retail optical chains and nearly 55% of the top 25 wholesale U.S. optical labs.[25] Although near to bankruptcy in 1989, Nanofilm has since been able to bring their tough, long lasting "thin substances" to market. When technology for eyewear changed from glass to plastic lenses, their "thin substances" provided the strength needed for the new plastic lenses. Today, Nanofilm's substances are on one of every five pairs of eyewear sold.[26] In order to estimate potential financial projections, it is necessary to understand the current organization's propensity to provide products that customers perceive to have value, and to be able to appropriate that value. Nanofilm currently has a positive track record with their eyeglass products, and a potential, viable market for their first windshield product, Clarity Defender, introduced in early 2005.

It is estimated that the market for windshields would be much greater than eyeglasses, since comparatively there are more individuals that own more than one vehicle, whereas they would not necessarily own eyeglasses. Market information for anti-fog products was not readily available. The following assumptions were made to arrive at reasonable estimates, using limited information of the current vehicle market and suggested retail of Nanofilm's current automotive product, Clarity Defender.

The current total vehicle number worldwide is approximately 700 million cars with expected growth to 1 billion by 2015. Based on this fact, it is estimated that the number of new cars would increase by 30 million per year. A reasonable estimate of 5% was assumed from the total number of cars worldwide that would require an anti-fog product. This is based on geographic climate conditions conducive to moisture, cars with inoperable or inefficient defogger, or current unmet needs from use of substitutes, etc. This figure was further reduced by 50% to capture the consumer market that would be willing and able to pay for the product at the $15.00 suggested retail price. In addition, it is assumed that Nanofilm would only initially target 25% of the total market and increase new target markets by 2% per year. Using these assumptions, the overall market for Nanofilm's anti-fog products starts at approximately 4.5 million customers, and gradually

increases each year to about 7.7 million by 2011. See Table 1 for windshield market estimates.

Since several assumptions were used to determine the market for Nanofilm's anti-fog product, it was necessary to validate the numbers with a similar scenario. Armor All Protectant is an automotive product, which is used to protect and improve rubber, vinyl and plastic components of an automobile, including dashboards, tires, door panels, etc. Prior to Clorox Company's purchase in 1997, Armor All Protectant consisted of approximately 57% of revenues of the Armor All Products Corporation. Financial data revealed revenues for the protectant to be over $100 million for 1995 and nearly $128 million for 1996.[27] Based on this, the risk of overestimating Nanofilm's revenues was mitigated, in that revenues were reasonably estimated to start at roughly $3 million and gradually increase to $46 million by 2011.

Nanofilm would pursue a revenue model for the windshield anti-fog product to generate profit. They will appropriate value using a production revenue model, with direct product sales to provide their differentiated product that provides customers superior long lasting anti-fog benefits for their vehicle versus current substitute products.. The product would currently meet customer's unmet requirements, since current products are falling below customer expectations.

Revenues were based on the potential anti-fog market and the Clarity Defender product currently produced and marketed by Nanofilm. It is assumed that the anti-fog product will be comparable in price to the Clarity Defender product ($14.95 suggested retail). Reasonable market share is assumed to initially start at 5% for the first year, gradually increase until year 6 and flatten out at 40% market share. The optimistic market share is assumed to initially start at 5% and to double each year up to 40% market share and eventually flatten out at 50% market share. A conservative market share is assumed to also start at 5% and only gain a 5% increase per year until year 6 when it will flatten out, with Nanofilm realizing only about a 30% market share. See Table 1, for multiple scenario revenue estimates.

Year	Total Cars Worldwide	Total Market for Anti-fog	Total Car Market for Anti-fog	% Customers Willing to Pay	% Targeted Market	Total Customer Car Market
2006	730,000,000	5%	36,500,000	50%	25%	4,562,500
2007	760,000,000	5%	38,000,000	50%	27%	5,130,000
2008	790,000,000	5%	39,500,000	50%	29%	5,727,500
2009	820,000,000	5%	41,000,000	50%	31%	6,355,000
2010	850,000,000	5%	42,500,000	50%	33%	7,012,500
2011	880,000,000	5%	44,000,000	50%	35%	7,700,000
Car # Increased Per Year:	30,000,000					
Revenue Year	Reasonable Estimate	Conservative Estimate	Optismistic Estimate		Estimated Anti-fog Suggested Retail*	
2006	$3,421,875	$3,421,875	$3,421,875		$15.00	
2007	$7,695,000	$7,695,000	$7,695,000			
2008	$17,182,500	$12,886,875	$17,182,500			
2009	$28,597,500	$19,065,000	$38,130,000			
2010	$36,815,625	$26,296,875	$47,334,375			
2011	$46,200,000	$34,650,000	$57,750,000			
				*based on Clarity Defender price		
"Reasonable" Est. Market Share	2006	2007	2008	2009	2010	2011
Nanofilm	5%	10%	20%	30%	35%	40%
RainX	65%	60%	55%	50%	45%	45%
Other	30%	30%	25%	20%	20%	15%
	100%	100%	100%	100%	100%	100%
"Conservative" Est. Market Share	2006	2007	2008	2009	2010	2011
Nanofilm	5%	10%	15%	20%	25%	30%
RainX	65%	60%	60%	55%	50%	50%
Other	30%	30%	25%	25%	25%	20%
	100%	100%	100%	100%	100%	100%
"Optimistic" Est. Market Share	2006	2007	2008	2009	2010	2011
Nanofilm	5%	10%	20%	40%	45%	50%
RainX	65%	60%	55%	40%	35%	35%
Other	30%	30%	25%	20%	20%	15%
	100%	100%	100%	100%	100%	100%

Table 1
Revenue Estimates for Anti-fog Windshield Product

Estimated Cost Structure

Based on Nanofilm's other products, it is assumed that the largest share of the costs associated with their business model, would fall into R&D of new and improved

products and the manipulation process of the nanoparticles to be applied or adhered to products (which would be classified as fixed costs). It was also assumed that variable costs would be relatively low, based on company statements regarding nanomaterials for windshield products. It is assumed that any permanent technologies would also have a temporary upward effect on R&D fixed and production variable costs, but other variable costs could be further reduced with economies of scale and learning curves. Marketing and selling costs would be higher in the early stages of product adoption.

This trend for nanotechnology companies to have higher R&D and fixed costs early was confirmed in the minimal nanotechnology financial data that was accessed (see spreadsheet in Appendix A under Nanotechnology Companies). Financial data was researched for Veeco Instruments, a diversified, publicly traded nano-company that manufactures tools to measure at the nanoscale, and Nanophase, a company that develops and markets nanocrystalline materials in a variety of commercial applications. Both companies have a large share of operating expenses in R&D and SG&A costs to continue their technology development. The drawback is there were not enough nanotechnology companies with data available to make a confident assessment. The financial projections for Nanofilm were adjusted from the benchmark firms to account for this possible trend of higher fixed costs in relation to variable costs.

Several companies were researched to achieve benchmark cost estimates (see Appendix A for specific details). The companies researched were Kimberly Clark, PPG Industries, Inc., 3M, Procter and Gamble, Clorox Company and Dow Chemical. These companies were selected in that they manufacture items with glass and chemical coatings, and commercial and microfiber wipes, which are assumed to have relatively similar cost-driver activities, to make a reasonable estimate. The companies used for the benchmark estimates are typically very large, diversified and consist of many subdivisions. The subdivisions were generally responsible for several products making it impossible to drill down and obtain estimates specifically related to Nanofilm's anti-fog product. The assumption is that these subdivisions used primarily the same processes or cost-drivers associated with the target products used for the analysis.

Variable costs (cost of goods sold) were on average about 61 percent and fixed costs were about 27 percent of revenues for a total cost of 88% for the benchmark industries (see Table 2). All the companies, with the exception of 3M, had high variable costs at least more than double fixed costs. 3M had slightly lower variable costs than fixed costs (46% versus 48%, respectively), and this is indicative of a firm that reinvests into R&D and product development. Based on the assumption that Nanofilm would more closely pattern this trend, these benchmark averages were adjusted to 40% for variable costs and 48% for fixed costs to reflect the R&D intensiveness and lower variable costs associated with Nanofilm's business model. These estimates were provided as the reasonable estimates in the multiple scenarios in Table 3. EBIT margins were used from the benchmark firms and reflect a reasonable EBIT estimates of 12% (benchmark EBIT average) for the reasonable scenario, 20% for optimistic (Clorox Company EBIT) and 6% for conservative (3M EBIT).

Summary of Industry Cost Percentages/Averages							
	Kimberly Clark	PPG Industries	3M	Procter & Gamble	Clorox Co.	Dow Chemical	**Industry Averages**
Revenues	100%	100%	100%	100%	100%	100%	**100%**
Less Variable Costs	65%	63%	46%	51%	55%	86%	**61%**
Gross Margin	35%	37%	54%	49%	45%	14%	**39%**
Less Fixed Costs	19%	29%	48%	31%	25%	8%	**27%**
EBIT Margin	16%	8%	6%	18%	20%	6%	**12%**
High Variable Costs (more than double)							
High Fixed Costs (less than VC)							

Table 2
Summary of Benchmark Industry Cost Percentages and Averages

Risk Analysis

As with any new venture, there are risks. As Nanofilm chooses a strategic partner to contribute the necessary complementary assets, there are a number of issues they need to decide before entering into any agreements. The first would be how they want to protect their proprietary nanotechnology processes. They need to decide how much they are willing to share on how it is made. They need to ascertain what their long term strategy will be and how to best protect their intellectual property. A second risk with an alliance would be the possible power differential between Nanofilm and the holder of the required complementary assets. A way for Nanofilm to mitigate this risk is to find more than a single company to approach with an agreement. A third risk would be Nanofilm's lack of knowledge when it comes to entering the automotive products field where they have little experience. This choice to move into an area outside their core competencies could create an over dependence on their strategic partner. This aspect would have to be monitored closely to keep Nanofilm from being taken advantage of. The fourth risk associated with an alliance has to do with the above stated dependence. By Nanofilm relying on the complementary assets of a strategic partner, they would have to closely watch how the partner's company is being run. Strategic decisions made by the partner could have an adverse affect on Nanofilm's business.

Currently the balance between fixed and variable costs is favorable. Fixed costs have been high due to the extensive R&D while variable costs have been low due to inputs such as the cloth and the formula for the anti-fog compound. Not knowing exactly how the compound is made doesn't allow a guess as to how low these costs can be. The costs of the cloths can be kept low by the worldwide network of suppliers. Fixed costs should only go down as the highest cost should have been realized in the creation of the unique compound. R&D should decrease due to lower costs associated with improving a product versus the actual creation of a product. This should slowly cause the overall cost to decrease in favor of enhancing Nanofilm's bottom line.

In the long term, once Nanofilm's patents expire within 10 years, there is the possibility of increased competition. This is still an unknown due to the secretive

process Nanofilm uses to create their anti-fog product. It is not known whether the process would be easy/hard to duplicate or whether it would be cheap/expensive to produce the same product. This is an unknown risk at this point, but one Nanofilm should look at to assess the potential future impacts.

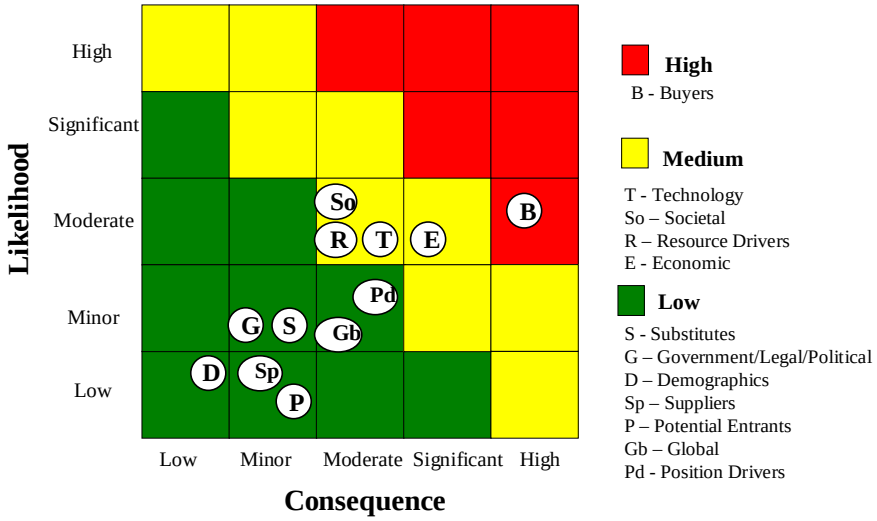
There are some risks associated with buyers of the anti-fog windshield product. Currently, there is no customer loyalty, since Nanofilm is a new entrant into the automotive product market and they lack brand recognition. With the numerous viable substitutes on the market, Nanofilm needs to assume the risk of aligning with a company with strong complementary assets (e.g. Armor All), to help them introduce their product. Sales will naturally follow due to the strong marketing and promotion provided by the company alliance. Once the initial sales are achieved, there will be repeat sales, since this differentiated product provides superior customer value. Additionally, Nanofilm brings to the potential market their quantum leap into the world of applied nanotechnology, from which leader sales will be achieved by those buyers that value new technology and wish to try nano-products. The ability to pay should be a low risk, since Nanofilm's longer-lasting product is comparable in price to substitutes' price with much shorter application, so more of the product is required. The ability to pay risk will only increase under poor economic conditions, as mentioned above.

Cost drivers bring risk to the Nanofilm's business model as shown in the Risk Summary chart below. Buyers pose the greatest risk to Nanofilm, since there is only a very small market without the strong complementary assets needed to attract customers and induce sales. Medium risks include technology, economic, societal and resource drivers. Technology can come from anywhere, at anytime, therefore a risk will be prevalent until Nanofilm can get its product into the mainstream and establish buyer loyalty. Disruptive technology in permanent anti-fog application can also pose a threat. Economic forces pose risks in that customer's may not buy the product if there is an economic downturn. Societal forces will also pose a risk, since nanotechnology is still new and the long-term affects of disposing of nano-materials in the environment is undetermined. Resource drivers include quality, quantity and rate. Currently, Nanofilm's product provides value, is rare, and cannot be imitated due to patent barriers. There are substitutes, but they fall short of consumer expectations, making switching to Nanofilm's product a viable option. These resources are costly, though and are evidenced by their higher fixed costs. Also, Nanofilm does not have economies of scale at this time, due to low sales, but which can be achieved through strong complementary assets. Because Nanofilm is manufactured and distributed from Ohio, rather than another higher income area, they can take advantage of lower area costs and taxes, thereby enjoying economies of rate.

The rest of the cost drivers are considered low risks to Nanofilm. Suppliers have little or no bargaining power due to sheer number available. Substitute products, although in abundance, do not measure up to Nanofilm's superior product and long-lasting qualities. Potential entrants are also blocked at this time, due to Nanofilm's patents and intellectual property. Macro environment forces such as government/legal/political are reduced risks, due to benefits that Nanofilm is receiving or will receive due to support of nanotechnology within the U.S. government. Demographics risks are low, due to the sheer size of vehicle windshields and non-sensitivity to demographics. Global forces are also reduced by Nanofilm's global perspective in their business model. Position drivers including customer value, strength of position and price are all low risks since Nanofilm can sell their differentiated product at a comparable price within the market and seem to have favorable position, with the exception of buyers, via their suppliers, substitute competitors, and new entrants.

The only three unknown risks are complements, competitors and activity drivers. There are currently no direct competitors for Nanofilm's product, as well as complement products to consider. The activity drivers of the business model of which activities they perform, how they perform their activities, and when they perform them were unknown due to the private nature of their business. Nanofilm does hold a first-mover advantage in anti-fog nanotechnology for automotive windshields.

Risk Summary – Anti-fog Cost Drivers



May 31, 2005

Multiple Scenarios

The multiple scenarios for revenue, variable and fixed costs, and net profit are shown in Table 3. The reasonable scenario is based on adjusted industry benchmark company variable and fixed cost averages, 40% and 48% respectively. These higher fixed costs are indicative of higher R&D and selling/marketing costs associated with getting a product through development and to market. The optimistic estimate assumes an equivalent cost mix of 40% fixed and 40% variable costs. The EBIT reasonable estimate is derived from the 12% industry average of EBIT to revenue. The optimistic and conservative EBIT percentages were adjusted to reflect the highest EBIT margin from the benchmark firms (Clorox Company) and lowest EBIT margin (3M).

Under the reasonable scenario, Nanofilm can expect to initially achieve an EBIT of nearly $400,000 the first year, which would increase to $5.5 million by 2011. EBIT is estimated to cap at $11.5 million by 2011 for the optimistic scenario and $2.0 million under the conservative scenario. Based on $20 million overall revenue for Nanofilm in 2004, the windshield anti-fog product would reasonably increase total revenues by nearly 2% in 2006 to 28% by 2011.

Reasonable Estimate						
						Basis for Cost Estimate
Revenue Year Nanofilm	Revenue Estimate	Variable Costs	Gross Profit	Fixed Costs	Estimated EBIT	**Industry Average EBIT Applied**
	100%	40%	60%	48%	12%	**IA Avg**
2006	$3,421,875	1,368,750	2,053,125	$1,642,500	$410,625	
2007	$7,695,000	3,078,000	4,617,000	$3,693,600	$923,400	
2008	$17,182,500	6,873,000	10,309,500	$8,247,600	$2,061,900	
2009	$28,597,500	11,439,000	17,158,500	$13,726,800	$3,431,700	
2010	$36,815,625	14,726,250	22,089,375	$17,671,500	$4,417,875	
2011	$46,200,000	18,480,000	27,720,000	$22,176,000	$5,544,000	
Optimistic Estimate						
	100%	40%	60%	40%	20%	**IA High**
2006	$3,421,875	2,053,125	1,368,750	$1,368,750	$684,375	
2007	$7,695,000	4,617,000	3,078,000	$3,078,000	$1,539,000	
2008	$17,182,500	10,309,500	6,873,000	$6,873,000	$3,436,500	
2009	$38,130,000	22,878,000	15,252,000	$15,252,000	$7,626,000	
2010	$47,334,375	28,400,625	18,933,750	$18,933,750	$9,466,875	
2011	$57,750,000	34,650,000	23,100,000	$23,100,000	$11,550,000	
Conservative Estimate						
	100%	45%	55%	49%	6%	**IA Low**
2006	$3,421,875	2,053,125	1,368,750	$1,676,719	$205,313	
2007	$7,695,000	4,617,000	3,078,000	$3,770,550	$461,700	
2008	$12,886,875	7,732,125	5,154,750	$6,314,569	$773,213	
2009	$19,065,000	11,439,000	7,626,000	$9,341,850	$1,143,900	
2010	$26,296,875	15,778,125	10,518,750	$12,885,469	$1,577,813	
2011	$34,650,000	20,790,000	13,860,000	$16,978,500	$2,079,000	

Table 3
Revenue/Cost Multiple Scenarios for Anti-fog Windshield Product

Conclusion

Nanofilm has a proven track record when it comes to applying their nanotechnology developments to real-world products. They have a string of products that are proven successes in the eyeglass field. Their experience at applying nanotechnology to glass surfaces has led them to develop the Clarity Defender product for the outside of the windshield and will enable them to compete against the market leader, Rain-X. Their new target of adapting their Clarity Fog Eliminator for the inside of automotive windshields will again allow them to compete against the market leader in

anti-fog, Rain-X anti-fog. But Nanofilm would be making a mistake if they tried to do it on their own.

Nanofilm is in a very good position to take their nanotechnology products to the next level. They have developed a high quality product in their Clarity Fog Eliminator and have targeted a very viable windshield market. The only missing piece to make Nanofilm even more successful is to establish an appropriate strategic alliance that will provide the necessary complementary assets that Nanofilm lacks. One of the keys will be the structuring of the agreement to make sure they still have control over their products and therefore, their destiny. With Nanofilm creating, developing, and successfully marketing their products since 1985, there is full confidence they will make the right decisions to ensure their successful future.

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Appendix A

Company	Year	Revenues In Millions $	Cost of Goods Sold	Gross Margin	% GM	Total Fixed Costs	EBIT	EBIT % of Revenue
Kimberly Clark	2004	$15,083.20	$9,834.00	$5,249.20	0.35	$3,092.20	$2,157.00	0.14
	2003	$14,348.00	$9,448.10	$4,899.90	0.34	$2,602.50	$2,297.40	0.16
	2002	$13,566.30	$8,750.70	$4,815.60	0.35	$2,651.20	$2,164.40	0.16
Average per Co.		100%	65%		35%	19%		16%
Products:								
Commercial wipes (Kimwipes, WypAll), Baby wipes								
PPG Industries, Inc.	2004	$9,513.00	$5,999.00	$3,514.00	0.37	$2,361.00	$1,153.00	0.12
	2003	$8,756.00	$5,521.00	$3,235.00	0.37	$2,285.00	$950.00	0.11
	2002	$8,067.00	$5,066.00	$3,001.00	0.37	$2,901.00	$100.00	0.01
Average per Co.		100%	63%		37%	29%		8%
Products:								
Glass & chemical coatings, automotive glass, adhesives & sealants, transitions optical products								
3M	2004	$20,011.00	$9,105.00	$10,906.00	0.55	$9,431.00	$1,475.00	0.07
	2003	$18,232.00	$8,321.00	$9,911.00	0.54	$8,709.00	$1,202.00	0.07
	2002	$16,332.00	$7,542.00	$8,790.00	0.54	$7,824.00	$966.00	0.06
Average per Co.		100%	46%		54%	48%		6%
Products:								
Industrial business (tapes and adhesives), coatings & finishing prod manuf., plastic & microfiber cloths								
Procter & Gamble	2004	$51,407.00	$25,076.00	$26,331.00	0.51	$16,352.00	$9,979.00	0.19
	2003	$43,377.00	$22,141.00	$21,236.00	0.49	$13,145.00	$8,091.00	0.19
	2002	$40,238.00	$20,989.00	$19,249.00	0.48	$12,263.00	$6,986.00	0.17
Average per Co.		100%	51%		49%	31%		18%
Products:								
Swiffer & Cleaning Products								
Clorox Co.	2004	$4,324.00	$2,387.00	$1,937.00	0.45	$1,065.00	$872.00	0.20
	2003	$4,144.00	$2,225.00	$1,919.00	0.46	$1,064.00	$855.00	0.21
	2002	$4,022.00	$2,279.00	$1,743.00	0.43	$983.00	$760.00	0.19
Average per Co.		100%	55%		45%	25%		20%
Products:								
Handi-Wipes, Rain Dance, Armor All (1997)								
Dow Chemical	2004	$40,161.00	$34,244.00	$5,917.00	0.15	$2,458.00	$3,459.00	0.09
	2003	$32,632.00	$28,177.00	$4,455.00	0.14	$2,373.00	$2,082.00	0.06
	2002	$27,609.00	$23,780.00	$3,829.00	0.14	$2,664.00	$1,165.00	0.04
Average per Co.		100%	86%		14%	8%		6%
Products:								
Plastics & fibers, chemicals, automotive sealants, fluids & plastics								
			COGS		GM %	FC %		EBIT % to Revenue
Industry Averages			61%		39%	27%		12%

Royal Dutch Shell-Major Anti-fog Substitute (for reference only; not all data available)								
		Revenue	Variable Costs	Gross Margin	GP % of Revenue	Total Fixed Costs	EBIT	EBIT % of Revenue
	2004	$201,728.00	N/A	N/A	N/A	N/A	$8,714.00	0.04
	2003	$179,431.00	N/A	N/A	N/A	N/A	$6,421.00	0.04
	2002	$135,211.00	N/A	N/A	N/A	N/A	$6,099.00	0.05
Products:								
RainX Anti-fog for Windshields								
Nanotechnology Companies (for reference only)								
Veeco 2004 Data (in thousands)	4th Qtr	$102,967.00	$64,377.00	$38,590.00	0.37	$43,517.00	($4,927.00)	(0.05)
	3rd Qtr	$97,367.00	$61,913.00	$35,454.00	0.36	$38,996.00	($3,542.00)	(0.04)
	2nd Qtr	$99,246.00	$58,331.00	$40,915.00	0.41	$40,495.00	$420.00	0.00
	1st Qtr	$90,863.00	$54,065.00	$36,798.00	0.40	$38,527.00	($1,729.00)	(0.02)
Products: Tools to		100%	61%		39%	41%		-2%
Nanophase	2004	$5.20	$5.12	$0.08	0.02	$6.49	($6.41)	(1.23)
	2003	$5.44	$5.20	$0.24	0.04	$6.03	($5.79)	(1.06)
	2002	$5.40	$5.09	$0.31	0.06	$5.39	($5.08)	(0.94)
	2001	$4.03	$4.89	($0.86)	(0.21)	$4.85	($5.71)	(1.42)
	2000	$4.27	$4.75	($0.48)	(0.11)	$4.03	($4.51)	(1.06)

Reference:
Hoover's Financials
Lexis Nexis Academic Database
Wright State University Libraries

Industry Benchmark Costs