Business Models & New Market Creation for Radical Innovation
New Market Creation

◆ Tools for Market Creation = Tools for Market Exploration
  ➢ Exploratory, Experimental, Interactive

◆ Learning by Using

◆ No Formal Market Launches … Rather,
  ➢ ‘Concept Launches,’
  ➢ ‘Whispering in People’s Ears,’
  ➢ ‘Alpha, Beta, Ship.’

◆ Objective: Generate Excitement about Potential Applications, Uncover More Beneficial Applications

◆ Positive Impact of Large Corporate Brand Name
◆ Many corporate constraints.
Efforts to develop a truly practical degradable material are reaching fruition. DuPont scientists have created an inexpensive polymer that decomposes without harm to the soil or the environment.

By now, the problems associated with overburdened landfills are widely recognized. Although recycling is the preferred solution, degradable materials can also play an important role. Yet, cost barriers and other issues have consistently blocked their wide-scale adoption in major consumer applications.

To meet this challenge, DuPont scientists have created a new family of highly versatile polymers based on polyethylene terephthalate (PET) technology and known commercially as DuPont Biomax® hydrobiodegradable polyester. Depending on the application, up to three proprietary aliphatic monomers are incorporated into the polymer. The monomers create weak spots in the polymeric chains, thereby making them susceptible to degradation through hydrolysis. The large polymer molecules are cleaved by moisture into smaller molecules, which are then consumed by naturally occurring microbes and converted to carbon dioxide and water.

A polyester that microbes find tasty.

Biomax® can be recycled, incinerated or landfilled, but is intended mainly for disposal by composting and in-soil degradation. Researchers performed a series of tests to determine environmental impact, including plant germination and seedling emergence, earthworm weight gain and mortality, and microbial population density. In all tests, the materials were found to be harmless to the environment at every stage in the decomposition process. They are virtually undetectable to the unwieldy eye in about eight weeks.

Because Biomax® is a modified PET polymer, it can be manufactured with existing equipment using existing bulk monomers. This means that it is only marginally more expensive to produce than PET itself. Currently available degradable materials, on the other hand, cost twice as much.

How to make your products disappear. The sheer number of potential applications for Biomax® is immense. Because it can be made into fibers, films or resins, it is suitable for a range of single-use products, including domestic wipes, yard waste bags, the top and back sheets of disposable diapers, blister packs and disposable eating utensils. It can be used to create geotextiles, agricultural films, seed mats, plant pot and bags that cover ripening fruit. It can find application in coated paper products such as disposable plates and cups, aluminized films for food packaging and hot-melt adhesives. It is also suitable for thermoformed packaging, blown bottles and injection-molded objects.

Product properties are diverse and customizable, but are generally tailored to mimic polyethylene or polypropylene. Biomax® is soft, pliable, low in noise and has a good hand. Melting points are high for a degradable material, generally around 200°C, which opens up a range of processing options. It can be formulated to be as low in strength as low-density polyethylene or as high as half the strength of DuPont Mylar® polyester film. Elongation can range from 50 to 500 percent.

A world with less trash. Share the dream.

Throughout DuPont's history, many of our most important contributions have only come to market through collaboration with other companies. If the substance of this article leads you to conclude that a development opportunity might exist between your company and DuPont, fax us (at 302-695-9840) an outline of your non-confidential idea on your company letterhead.

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Better things for better living

Rensselaer LALLY SCHOOL OF MANAGEMENT & TECHNOLOGY
The orb-weaving spider produces one of the world’s toughest fibers. Using recombinant DNA technology, DuPont scientists have created synthetic spider silk as a model for a new generation of advanced materials.

It has been suggested that a single strand of spider silk, thick as a pencil, could stop a 747 in flight. Whatever comparison you use, the dragline silk of the orb-weaving spider is an impressive material. On an equal weight basis, it is stronger than steel. In addition, spider silk is very elastic. It is this combination of strength and stretch that makes the energy-break of spider silk so high. Simply put, it is the toughest material known.

Spider silk is merely the most dramatic example of a sizable family of biopolymers possessing a combination of properties that synthetic materials cannot yet approach. At DuPont, our researchers are looking to these natural materials as paradigms for the design and synthesis of a new generation of advanced structural materials.

Secrets of spider silk, unraveled. Learning exactly how the spider makes its silk is important because this knowledge can serve as the basis for a new generation of materials. Fundamental to achieving these materials is the ability to control all aspects of the material architecture, beginning at the molecular level. Recombinant DNA technology provides a practical route to harnessing the power of the biosynthetic process to control polymer sequence and chain length to a degree that is otherwise impossible.

A broad range of mechanical properties is accessible by careful selection of the appropriate building blocks, as are more sophisticated properties that are common among proteins.

What makes spider silk so tough?
A unique combination of strength and stretch.

For spider silk, we used advanced computer simulation techniques to design a molecular model that integrates all the information available to date about the structure of this amazingly strong and elastic fiber. Synthetic genes were designed to encode analogs of the silk proteins. These genes were inserted into yeast and bacteria and the protein analogs were produced. The biosilk was then dissolved in a solvent and the protein was spun into fibers using spinning techniques similar to those of the spider.

Will synthetic spider silk change the world? We envision many possible uses for biosilk. Textile applications are an obvious one. We could improve the elasticity and strength of existing products such as DuPont Lycra® brand spandex and nylon. Because it is lightweight, tough and elastic, biosilk may also have applications in satellites and aircraft.

More importantly, the new generation of advanced materials that spider silk research may bring about has the potential to transform our lives in countless ways we can scarcely imagine. It has been over 50 years since the discovery of Wallace Carothers and his team that gave the world nylon and ushered in the age of polymers. Based upon the success of our initial demonstrations, we believe that harnessing biosynthesis will play a major role in the new materials revolution.

What do you see that we cannot? Throughout the history of DuPont, many of our most important contributions have come to market only through collaboration with other companies. If the substance of this article leads you to conclude that a partnership opportunity may exist between your organization and DuPont, we invite you to fax us on company letterhead with an outline of your idea to 302-695-9840.

Better things for better living.
DuPont scientists are helping to make displays for TVs and computers lighter, brighter, more efficient, and yes—flatter—than ever.

A new kind of television has arrived. Developed by Matsushita with assistance from DuPont, the 26-inch sets are only 1.56 inches thick and are designed to be hung on a wall. And a 40-inch, three-inch-thick, high-definition model, being developed through a consortium led by Japan’s broadcasting company, NHK, is on the way. The units feature plasma display panels, which deliver a picture quality that is actually superior to that of their bulky predecessors. DuPont contributes proprietary thick film pastes, resistor materials and ceramic tape to both of these endeavors.

A knock for flatness. The plasma display panel is only one example of DuPont innovation in flat panel technology. In fact, our scientists have been developing key materials since flat panel displays first began evolving. DuPont is actively seeking additional partners as the industry progresses to the next generation of flat panel displays, including new liquid crystal displays, field emission displays and designs featuring polymer LEDs. Core technologies that are being brought to bear in these efforts by DuPont encompass polymer chemistry, photopolymers (including thick film pastes and holographic optical elements), controlled adhesion coatings, fine particle dispersions and precision pattern generation.

Just over the horizon. In existing liquid crystal display panels, such as those found in laptop computers, only a small fraction of the light generated by the backlight makes it out of the display. To improve efficiency, DuPont researchers see an opportunity to utilize holographic devices. One possibility is a holographic color filter that passes the appropriate color but reflects the rest of the light back in for recycling. Another is a diffusion screen composed of an array of holographic micro lenses for better control of horizontal and vertical viewing angles.

Another product that may soon find application in display screens is optically clear DuPont Teflon® fluoropolymer resin. Teflon® is a clear choice for anti-reflective and protective coatings to extend screen life, because it has the lowest refractive index of any polymer and is impervious to chemical attack.

A leap into the future. DuPont researchers envision a day when light emitting plastics will replace the fluorescent backlights in liquid crystal displays. Ultimately, the entire display, not simply the backlight, could be fashioned using polymeric light emitting diodes and instantly shed several pounds from laptop computers. DuPont scientists are currently applying their expertise in precision polymer processing to this challenging task.

Finally, field emission displays (FEDs) comprise a technology that promises many of the desirable features of CRTs in the thin configuration of a flat panel display. DuPont is actively working on new proprietary materials that could be of great value to companies developing FEDs.

Let’s put our heads together. Throughout DuPont’s history, many of our biggest contributions have come to market through collaboration with other companies. If you are active in the area of flat panel displays, there may be an opportunity for us to work together. We invite you to fax us on company letterhead with a description of your program and goals to 302-695-7615. Please limit your correspondence to non-proprietary, public-domain information only.

Better things for better living.
Strategy for Entering New Markets

- Criteria for Choice of Initial Entry Application for Radical Innovations Run Counter to Most Operating Units Requirements

- Initial Entry Points Likely Smaller than Expected with No Real ‘Killer App’ Early On

- Smaller Applications Lead to Killer Business

- Interim Performance Metrics Linked to Growth In Market Interest and Activity are Critical to Positioning Organizational Value
What the literature has to say

- Well established that large firms should be motivated to successfully commercialize new technology
  - Shortened Product Life cycles for many reasons (Golder and Tellis ‘97, Bayus ‘98, Nevens, Summe and Uttal ‘90)
  - Displacement by disruptive technologies (Christensen ‘97)
- Really new technologies experience slow take-offs (Golder and Tellis ‘97, Kanter ‘91), but mgrs. are poor judges (Twiss ‘84).
- A firm’s failure to exploit radical innovation has more to do with business and organizational adaptation issues than with technical challenges (Christensen ‘97, Grandstrand, Patel and Pavitt ‘97).
New Domains present new learning challenges

CURRENT STRATEGIC “FOUL LINES” (STRATEGIC FRAMEWORK OR CONTEXT)

outside strategic frame

within

within current lines of business

within

white space

white space
Innovations within Lines of Business (5 of 13 cases)

Key challenge: Receiving unit’s perceived risk of adopting:

Mechanisms for coping:
- Building trust and credibility over history of relationship
- Ensure that the familiar business model is used
- Convince the receiving unit that this is really nothing very different, offer as a replacement for current products

Tyranny of current biz model suboptimizes potential.
To the greatest extent possible, our projects try to stick with known business models and routines to help get the SBU to adopt... We have to make this first introduction fit as well as we can into the existing business structure, because all the business people who tend to be much more focused on make money in the present want a technology that can fit into that. My responsibility as a development engineer is to try to take a new technology and make it fit into that paradigm. We’ll spend $60 million inventing the technology I don’t want to spend another $60 million inventing a business.
Observation #2

- Business Model considerations begin to happen very early in the development process, as soon as the initial application choice is made to turn the technology into a product. Scientists who are making these decisions are unaware of their impact.
  - Initial application choices are based on experience with current markets or availability of willing partners...so ideation is constrained.
Observation #3

- Developing a business model through building a new value chain is experimental in nature, may lead the firm away from its familiar markets and business models, and evolves as the market increases its understanding of the technology.

- We change our business model every five days!“
Discovering the Appropriate Business Model

- Which path to the market?
- What parts of the value chain will the firm retain versus outsource?
- How to entice additional members?
Definition: The activities/operations a company engages in that are associated with making money from an opportunity.

➢ From a single company perspective:
  ▪ The role a company plays in the value chain.
    • What value does it add to creating and delivering the offering to the end user?
    • How does it make money (both revenue and profit) from the business opportunity?

➢ From a NBC perspective:
  ▪ The roles respective agents play in the value chain.
    • The value each adds.
    • How each makes money.
  ▪ Answers the question: ‘Who pays whom to do what?’
Discovering the Appropriate Business Model

- Business Model Design and Development Highly Experimental (e.g., Nortel Networks and Dupont)
  - Logic Puzzle
  - Systems Thinking
  - Mechanisms for Envisioning Entire Value Chain

- Market Learning Likely to Lead Company Away from Familiar Business Models

- Value Chain Creation Stretches Company into New Business Areas (e.g., Texas Instruments)
  - Not Areas of Natural Strength
  - Business Model Evolves as Market Learns about New Technology and Infrastructure Requirements
  - Company May Require Temporary Infrastructure to Educate Partners/Accelerate Value Chain Development
Downstream Changes:

We were dragged kicking and screaming into this one. It is counter to the culture of how we do business.

If people don’t rent, we don’t make money. It’s a fascinating model for a product company.

Upstream Changes:

We have a very complicated business arrangement with (our manufacturing partner). They basically hold title to the factory...But we have a lot of our people out there with a lot of technology invested. Ultimately what we had hoped for was a supplier relationship, but we’re having to support that a lot. And that may lead to a change in the business arrangement. I don’t know. Who knows what’ll happen?
Observation #4

- Initial entry applications for Breakthrough Innovations are smaller than expected by Operating units. Operating units apply inappropriate resources to market development activities, and inappropriate metrics for success to these efforts.
  - Interim performance metrics based on ‘action in the market’ critical.
  - Drive initial entry application choices.
Evidence of the Fallacy of the ‘Killer App’

<table>
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<tr>
<th>Project</th>
<th>Envisioned Killer Application</th>
<th>Actual Entry Application</th>
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<tr>
<td>GE Digital X-Ray</td>
<td>Chest Scanner</td>
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<td>TI Display Projection System</td>
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<td>IBM’s Silicon Germanium Chip</td>
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<td>Dupont’s Biodegradable Polymer</td>
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“Bernie kept dreaming... everybody kept dreaming... about the Home Run Plan... and that’s exactly what it was. It was... ‘how do you hit a home run?’ because people kept saying... oh cripes... after four years it’s only going to be $250 million, what do you need to make it a billion dollars? And so, we’d look at more applications... and we kept the skunk works on the GPS and other stuff because even though it wasn’t going to be gigantic, we knew that it would demonstrate, again, the building of the technology. I knew in my blood that the biggest application would take ten years. We knew that in the cell phone industry the value proposition was clear but, companies that are billion dollar businesses are not going to risk their business on new technologies... [so we went to an industry that was not stable, that was in turmoil].”
Observation #5

- Over time, killer businesses are built through the phenomenon of “application migration.” Example: Analog Devices’ MEMs technology
- With application migration comes the problem of diffused focus. To enter the market, the team must focus first, and then build a broader base of business from there. But the countervailing trend, pressure to make fast money, tempts them to stretch their resources across too many markets.
Evidence of Application Migration:
Analog Devices’ Accelerometer MEMS Device

Airbag Sensors for Automotive Industry (1992)

Process Improvements

PC Games (1998)

Box Games (Playstation) (1999)

Other automotive apps (1999)

Breakeven in Airbags (2001)

New Product Area Gyroscopes (2002)

Instrumentation (Medical) Inquiries (2000)


Optical Telecom (2001)
Application Migration: Words of Caution

◆ So many opportunities Diffuse Focus

◆ Moving from Exploration to Exploitation

◆ Focus of Team is to Enter Market with First Application
  ➢ Follow On Applications to Be Pursued Over Time to Build Broader Base of Business
  ➢ Pressure to Make Fast Money and Temptation to Stretch Resources Across Too Many Markets as a Result to Be Avoided
“It was apparent to me that we were trying to do too many things. And so consequently we weren’t moving any of them forward as fast as anybody really wanted…We’re going to have to choose the areas that we think we’re going to be successful in earliest…and we must choose the right number of customers to work with. So we scaled down from 40 initiatives to four market segments and 11 customers.”
Observation #6

- The tools for market development mirror the tools for market exploration.
  - Learning by using.
  - No formal market launches..rather, ‘concept launches,’ ‘whispering in peoples’ ears.’
  - Objective: to generate excitement about potential applications, and to uncover more beneficial applications.
  - Positive impact of a large corporate brand name.
Implication

- Conventional sales training and incentive programs may not be appropriate for radical innovation launches.
  - You know, salesmen are interesting people. They make their livelihood by getting trust and getting a relationship with customers. So before they bring anything in a really try to push a sale, they want to be absolutely sure that they’re not going to get burnt. So the hardest part of this was we didn’t get a lot of push in the sales team early on because they didn’t believe that the technology was there.
Competitors Drop Out and Take Up Rate Increases

Firms with Other Technological Approaches Drop Out Adding to Take Up Rate

“We’ve become the de facto standard.”

“Some of our competition has decided that they’re not going to aggressively go after the business, so we’ve gained several major car platform opportunities.”

“As far as we can tell, everyone else in this field (mammography) is dropping out because they haven’t been able to sustain the effort and the investment….As far as we know right now, we’ve got the whole marketplace to ourselves.”
We had originally assumed that these projects we move into the realm of low technical and market uncertainty...to the point at which they could move into a stage gate NPD process. They do not.

Implications for Operating Units are severe. New expectations, new organizational mechanisms needed to help ensure these projects don’t die on the vine.