



Cradle to Cradle Design Challenge

E-Commerce Shipping Packaging and Logistics



Background

Internet-based companies ship millions of books, CDs, DVDs, and videos each year. A large percentage of the shipping packaging associated with these purchases, primarily corrugated paperboard and plastic, ends up in landfills.

Existing consumer behavior, the wide distribution of e-commerce packages to residential areas, and the lack of packaging recovery infrastructure all suggest that these materials will become an increasing burden within municipal waste streams.

Cradle to Cradle Design provides a comprehensive vision of how the materials and systems used for e-commerce packaging can be redesigned and integrated to produce a more sustainable flow of packaging services.

E-commerce presents an ideal opportunity for system-wide implementation of innovative packaging solutions due to its dependence on highly integrated technology for product distribution and returns. E-commerce is strategically oriented to respond to the needs of the domestic and global marketplace. As international measures move towards extended producer responsibility, fees, and design for environment criteria, competitive participation will increasingly mean working throughout the packaging and logistics supply chain to ensure that the entire life cycle of packaging addresses these issues.

Corrugated, plastic, and various types of void fill are the materials most commonly used for e-commerce shipping packaging and for the larger parcel shipping industry. Together, corrugated and plastic represent roughly 25% of all packaging discarded in 2000.

(MSW In U.S. 2000: Facts and Figures)



The Design Challenge

As part of an initiative to investigate innovative solutions and strategies to eliminate or reduce waste, the U.S. Environmental Protection Agency (EPA), in partnership with McDonough Braungart Design Chemistry (MBDC), issued a design challenge. One of the intentions of the design challenge is to encourage a more integrated and comprehensive approach to the design of packaging. The goal is to develop more sustainable packaging services through the design of environmentally preferable packaging and the complementary systems needed for value recovery using cradle-to-cradle principles.



Cradle to Cradle Design Challenge

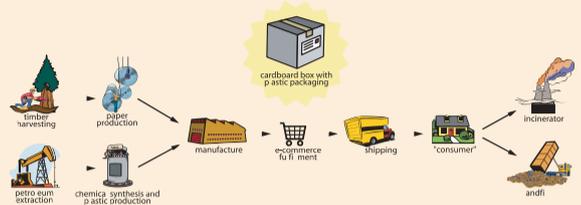
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Cradle to Cradle Design

The Legacy

Manufacturing systems of the Industrial Revolution are based on a one-way, cradle-to-grave stream of materials—a model that takes, makes, and wastes. The environmental and health effects of this system are becoming more and more evident. Governments and industries now seek to reduce these harmful impacts on the environment.



The Vision

Industry can be transformed into a sustaining enterprise—one that creates economic, ecological, and social value—through thoughtful and intentional design.

Cradle to Cradle Design proposes a new model for industry.

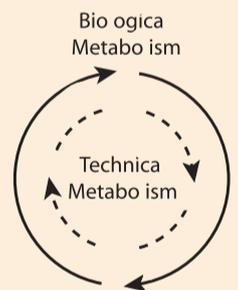
A New Paradigm

Cradle to Cradle Design is an approach to sustainability. It rejects the assumption that human industry inevitably destroys the natural world, or that the demand for goods and services is the ultimate cause of environmental ills.

Cradle to Cradle Design suggests innovative design based on the effectiveness of natural systems and eliminates the very concept of waste.

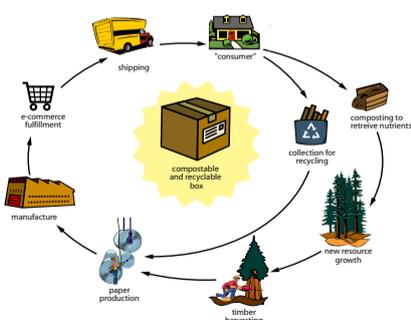
Its principles are built on the intelligence, abundance, and effectiveness of natural systems—the flows of energy and nutrients that support the Earth’s biodiversity.

Cradle to Cradle designs cycle nutrients in healthy metabolisms.



Emulating Nature’s Material Flows

The application of cradle-to-cradle principles to industry creates cyclical material flows—cradle-to-cradle rather than cradle-to-grave. All materials are perceived as nutrients, circulating safely and productively in one of two “metabolisms”—the biological metabolism and the technical metabolism.



The Biological Metabolism

The *biological metabolism* is the system of natural processes that support life. Materials that contribute to the productivity of the metabolism are *biological nutrients*. Human designs made from biodegradable, ecologically safe materials participate in the biological metabolism after use through decomposition.



The Technical Metabolism

Industry can create *technical metabolisms*, systems that productively cycle industrial materials. These materials are *technical nutrients*, designed to circulate safely through cradle-to-cradle product life cycles of production, use, recovery, and high-quality recycling.

The Bevelope

Category: Professional entry

Credits: Wm. Scott Ballantine, Microsoft; Allen Schluger, Allen Schluger Company; Chuck Vincent and Sam Tangorra, Shorewood Packaging



NUTRIENT TYPE

- Technical and Biological Nutrients
 - 100% post-consumer recycled content paperboard
 - Biodegradable inks and adhesive

RECOVERY STRATEGY

- Reuse
- Municipal paperboard recycling stream (technical metabolism)
- Composting (biological metabolism)

DESCRIPTION

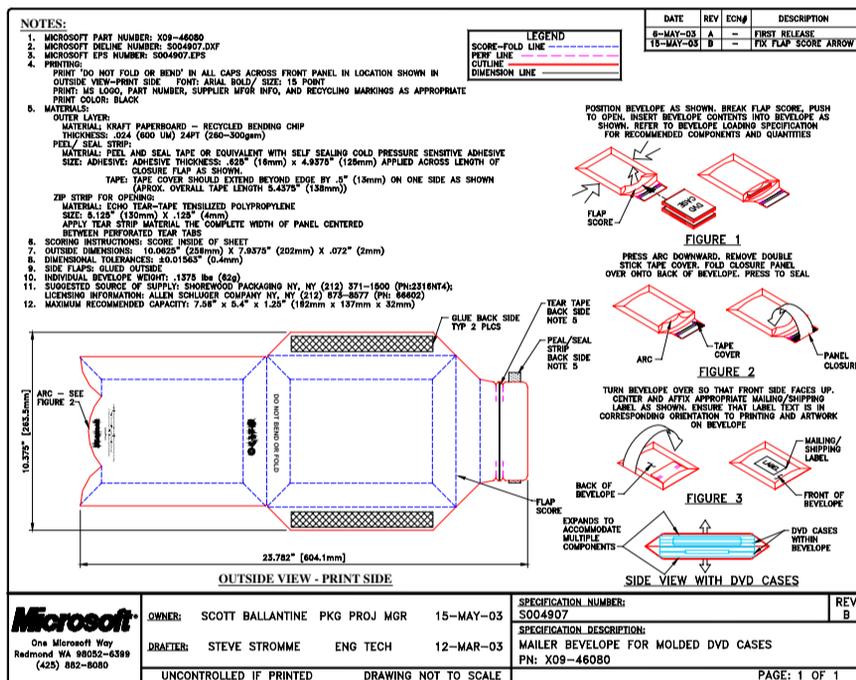
The key feature in the design of the Bevelope is the 'bevels' that help the package expand to accommodate products with different thicknesses. The adaptability of the Bevelope starts with just a few cleverly placed scores, creating bevels that make it possible to adjust the Bevelope's thickness to accommodate the slimmest paperback book, a molded DVD case, or a very thick manual. The bevels also help hold the products within the center of the packages, providing a protective cushion around the edges of the items during transit.

- It's easy to use, re-use, and recycle and very cost effective.
- It protects and accommodates a variety of individual and multiple types of products.
- It has unique, adaptable design features to meet various client, shipper, and customer needs.
- Content loading operations can be automated or manual.
- It can be printed with environmental markings, client and manufacturing information, as well as other customer related messaging.
- The materials used contain post-consumer recycled content and are easily recycled at end of useful life.
- It uses minimal materials, is lightweight, and reduces transportation energy and related handling costs.
- Space-saving, the Bevelope arrives preconstructed and flat and requires no additional filler materials when packing, thereby reducing assembly time.
- Once loaded, it has a unique appearance that increases customer interest in the package and ensures satisfaction through safe delivery.

We recently started shipping our Microsoft Office Home User & Licensing Edition products and other similar trials and evaluations products in Bevelopes designed to fit DVD cases. Our next step is to expand the use of this package across other similar products, go global in scope, and investigate other unique customer applications.

JUDGES' COMMENTS

- Like the fact that there is no inner packaging.
- Feel it will have improved recyclability compared to a corrugated box, because there is no need to break down the Bevelope and no internal packaging, so it can be more easily incorporated into the paperboard recycling stream.
- Being able to print the label directly onto the packaging may improve recyclability.
- Works well in existing fulfillment and distribution systems.



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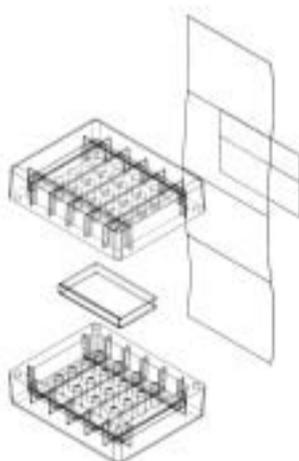


Patented by Allen Schluger Company.

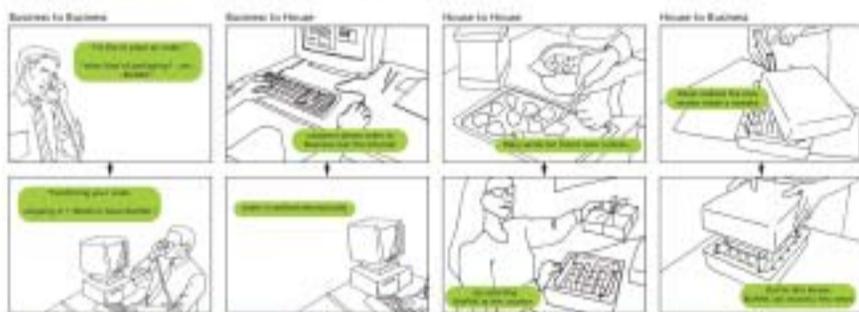
GrowPAK: BioPak

Category: Professional entry

Credits: Tony Guido and Barent Roth, **Growdesign**

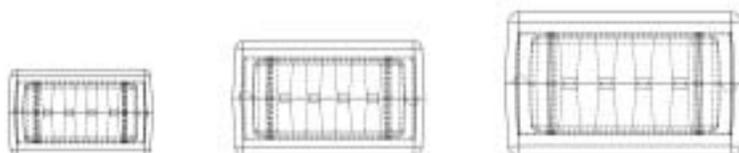


BioPAK: Biodegradable Shipping Scenarios



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E-commerce Shipping Packaging and Logistics

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NUTRIENT TYPE

- Biological Nutrient
 - Molded corn starch foam
 - Biodegradable, water soluble polymer wrapping and shipping label

RECOVERY STRATEGY

- Reuse (two or three times)
- Dissolving foam in water, in a sink or toilet

DESCRIPTION

BioPAK is a 100% biodegradable packaging option targeting users who don't have the time, ability, or motivation to reuse packages. Composed of a molded water-soluble cornstarch, all of the materials are integrated into the form as shock absorbent protrusions. When loading contents into a BioPAK shell, the items to be delivered are used to softly crush the protrusions creating a cradle for the contents. BioPAK is capable of approximately 1-3 shipments and is then cracked apart along break lines molded into the part. These smaller components are then dissolved harmlessly in water. Future versions could contain natural drain or toilet cleansers molded into the part, giving the disposal of BioPAK a positive, rather than merely neutral, effect on a plumbing system.

A water soluble wrap, containing a water soluble shipping label, surrounds BioPAK. This wrap gives the recipient the positive psychological effect of getting a brand new package even if it has been shipped multiple times. The wrap may also be customized to display the shipper brand identity prominently around the package (replacing the BioPAK graphics depicted in the model submissions). A waterproof rain blanket would be available for shipping drivers to cover all BioPAKs in the situation that the recipient is not available and the packages must be left outside in an area completely susceptible to the elements.

BioPAK specifies manufacturing in Small, Medium, and Large sizes. The protective shells are always made from only one mold for both halves, requiring only one mold per size.

JUDGES' COMMENTS

- Applaud the level of "outside the box" thinking evident in this entry.
- A particularly innovative aspect of the design was onsite packaging production.



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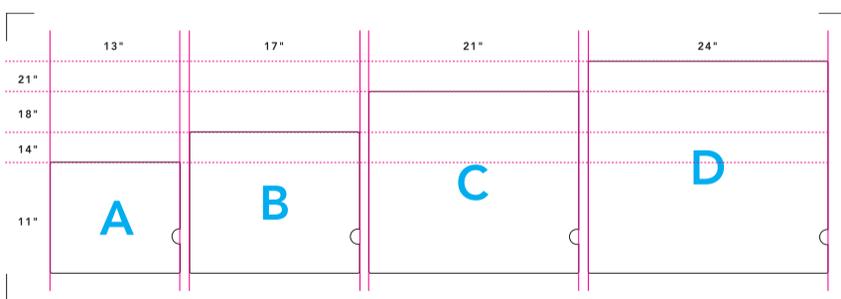
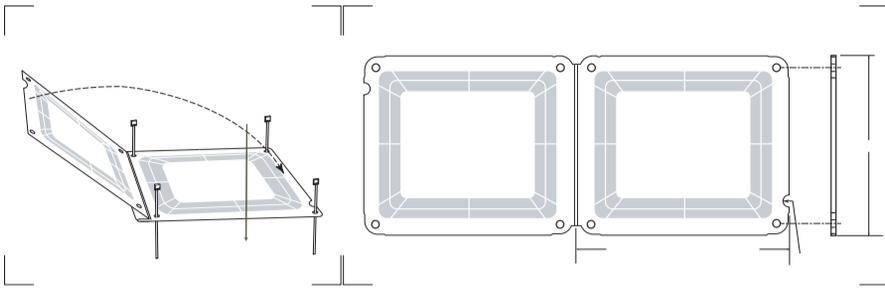
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Rapioli

Category: Professional entry

Credits: Seri McClendon, Ken Eskenazi, and Aaron Amaro, Clean Agency; Wendee Lee; Tom McCreery, 3M.



SIZE A	13 W X 11 H	UP TO 2 CDS OR DVDS
SIZE B	17 W X 14 H	1 SMALL TO MEDIUM BOOK
SIZE C	21 W X 18 H	2 MEDIUM BOOKS
SIZE D	24 W X 21 H	1 OVERSIZED BOOK

NUTRIENT TYPE

- Technical Nutrient
 - Prototype is polypropylene with acrylic adhesives
 - Envision production from 100% recycled PET polyester

RECOVERY STRATEGY

- Reuse
 - Buy a book and then send it (or another used book) back using Rapioli.
 - Retailer incentives and shipping it back empty (i.e. donating used book to library for credit on next purchase).
- Recycling

DESCRIPTION

Clean Agency introduces Rapioli™—a fully integrated shipping and packaging solution. Working with 3M, we will turn waste (soda bottles) into a durable, reusable, reclaimable (not to mention fun) technical nutrient. We also propose online alternatives for receiving and returning both products and packaging which will reduce landfill.

The Rapioli is a one-piece polypropylene clamshell with a clear window accommodating a label. Thumb notches make opening the package easier. The primary material is a revolutionary new product from 3M called Dual Lock™. Dual Lock Type 250 features a unique version of hook and loop. Both sides feature multiple tiny “mushrooms” that “mate” to form a strong bond. Pre-formed creases of incremental grooves allow for formation of materials around the products. The Rapioli package is designed to have minimum of two inches of thickness from product all around the edges. Each corner is secured with Double Lock Intermediate ties. For production, Clean Agency will work closely with 3M to ensure the source material of all plastic parts would be made from recycled water bottles (PET).

The Rapioli can be stacked in “brick” formation to allow for maximum space efficiency in airplanes and trucks. The Rapioli is designed for nearly unlimited shipments from distribution center to customer. The closure lifecycle of the material would allow up to 1,000 trips. The Rapioli collapses into a simple flat mailable unit after products are removed from the package.

JUDGES' COMMENTS

- Really innovative system incentive suggested to drive reusable packaging for e-commerce—reuse packaging to ship used books back to vendor.
- Liked the fact it could be made from sheet (not blown) plastic, as it is less energy intensive.
- Liked the possibility of a clear label window and the potential for a homogenous packaging.



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KNF (Keep it Nature Friendly)

Category: Student entry

Credits: Midori Yamanaka, Bella Chu, and Yotaro Tsuchiya,
the Art Center College of Design



NUTRIENT TYPE

- Biological Nutrient
 - Kenaf paper wrapping and felt protective corners
 - Gelatin-based adhesive tape and soy-based inks

RECOVERY STRATEGY

- Reuse
 - Corners fit together into tray for sprouting Kenaf seeds (included)
- Composting

DESCRIPTION

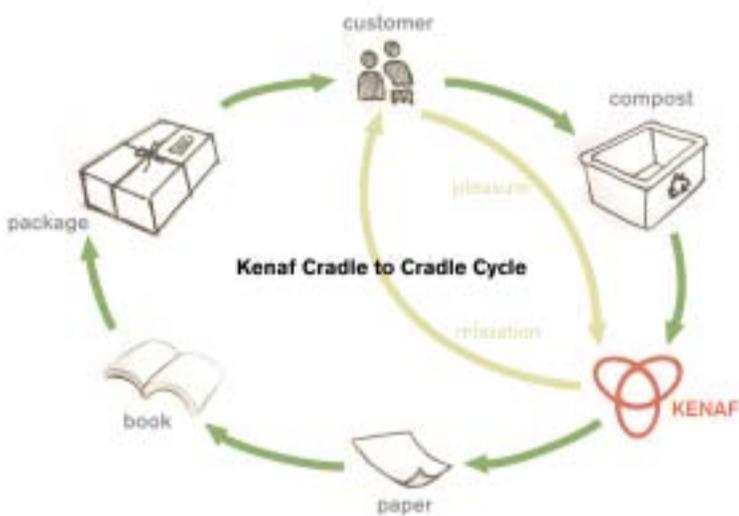
The use of the Japanese cloth as packaging, called Furoshiki ("furo" meaning bath and "shiki" meaning spread), dates back to the Nara period (8th century). Initially a way to wrap clothing while at a bathhouse, Furoshiki has since developed into a very flexible and expandable way of wrapping and transporting goods. It is this concept of adaptability that inspires the form of our design.

We are proposing that books be shipped this way, using strong paper corner protectors, to guard against damage. These corner guards are versatile, like the Furoshiki, in that they can accommodate any number or size of books. The entire assembly is then wrapped to secure the items in one parcel. A gelatin-based adhesive tape, is finally used to secure the package. Soy-based inks are used for the label printing, as well as the logo.

After the customer receives the package the wrapping materials are given a second life. The customer can choose to assemble the protective corners and use it as a germinator and plant pot. The corner caps are coated for water resistance (with a wax-based coating), and made of Kenaf, an herbaceous annual closely related to cotton and okra, with many benefits over wood-pulp paper. A bookmark is included with the ordered goods that contains Kenaf seeds and instructions to convert the corner protectors into a pot for growing them. All components are also safely compostable.

Kenaf:

- Fully biodegradable
- Does not require harmful chemicals to bleach
- Grows faster and produces more pulp than wood fibers
- Can grow in many parts of the United States
- Can be grown on defunct or rotational crops



JUDGES' COMMENTS

- Best embodied the spirit of the Cradle to Cradle Design Challenge.
- A good sense of metaphor for the life cycle of the material.
- Reuse at home is easy and attractive.
- Simple and dematerialized package.



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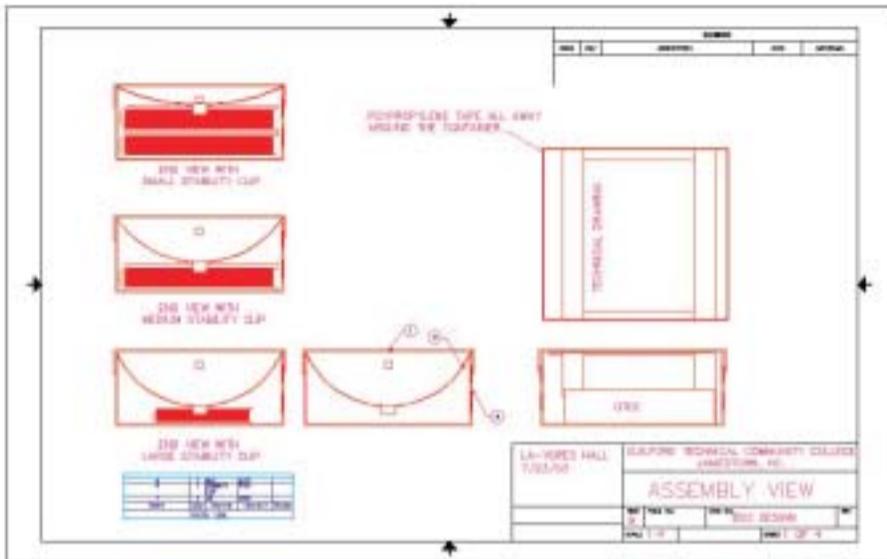
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Box Design

Category: Student entry

Credits: Michael Busch, Adam Combs, Maurice Dawson, Lorne Haithcox, Lavores Hall, Shi Liang, Max Witham, Guilford Technical Community College. Students of Craig Koretoff, Assistant Professor, Mechanical Engineering Technology Department, Guilford Technical Community College.



NUTRIENT TYPE

- Technical Nutrient
 - Injection molded polypropylene with 75% recycled content
 - Polypropylene tape and stability clips

RECOVERY STRATEGY

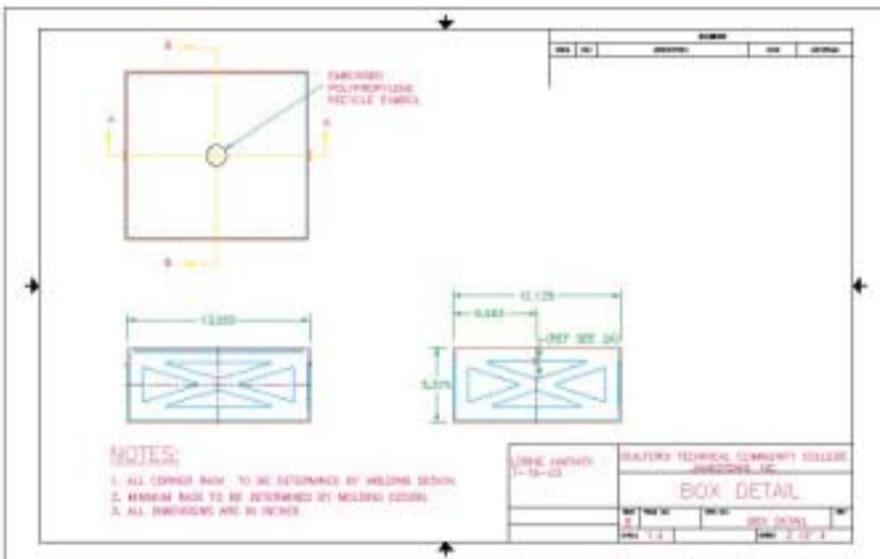
- Reuse
 - Proposed \$10 customer deposit to ship using this box
- Recycling

DESCRIPTION

The container and all components were designed out of polypropylene. The box itself has been designed with support ribs on all four walls to reduce the amount of material needed and still retain the polypropylene's compressive strength. Within the support ribs on the front and back sides an eighth of an inch below the top edge will be a runner, cut into the rib, to clip the stability clip into the container. The bottom of the box itself was designed with a smooth finish to prevent any scratching of the book(s) in the container. The lid of the container is a separate component that secures to the box with closure clips. To prevent tampering and to act as a weather barrier, a polypropylene tape seal has been added to seal the bottom edge of the lid to the sides of the box itself.

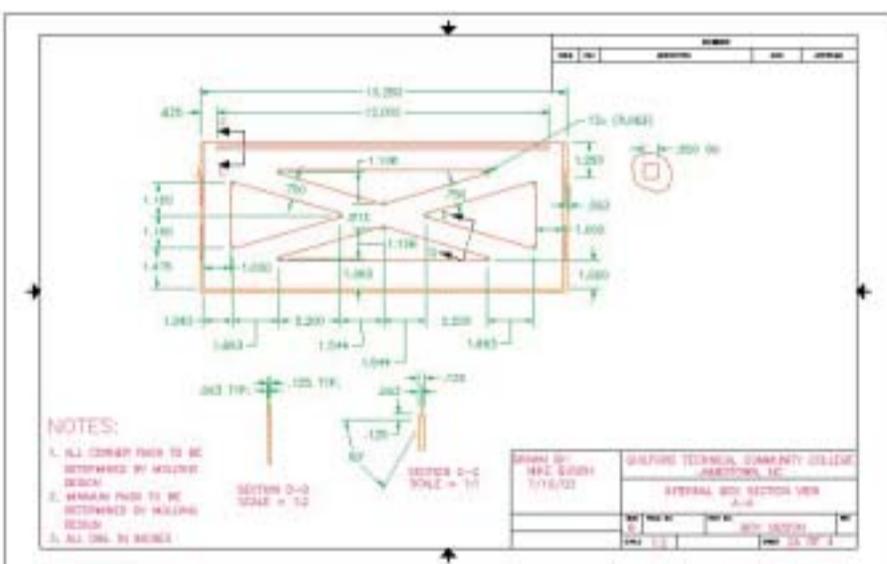
To hold the contents in place within the box there will be stability clips. Clips are bent and placed within the box resting inside the runners within the front and back sides of the box. The force from the bent clip pushing down on the contents prevents any vertical movement within the container. Also, the clips have a tab on the edge that sits against the sides of the book being held to prevent any horizontal movement.

Once in circulation, the container will be moved back and forth between the consumer and the e-commerce company using the U.S. Postal Service and other shippers, with no direct cost to the consumer. The container will stay in circulation until it is deemed unfit for use and sent to the original manufacturer to be recycled and made into a new container.



JUDGES' COMMENTS

- Liked the fact this was made from homogenous polypropylene with a polypropylene security tape. Seemed easy to use with the spring clips.
- Appreciated that this entry was sensitive to the cleaning issue that reusable packaging might necessitate.
- Commended its well researched effort to investigate the human health and eco-toxicological properties of its materials, the use of 'design for environment' tools, and the presentation of the dynamic effect of reuse on environmental and economic impacts.



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GENERIC

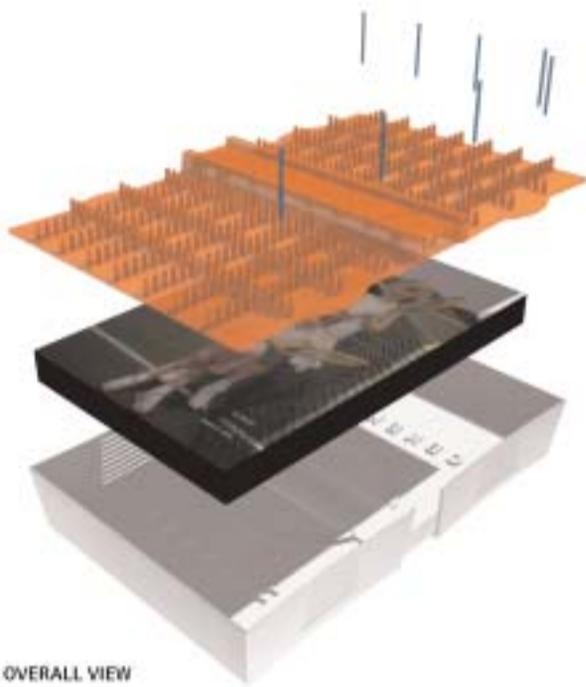
Category: Student entry

Credits: Alexandre LeClerc and Maxime Thibault,
Montreal University

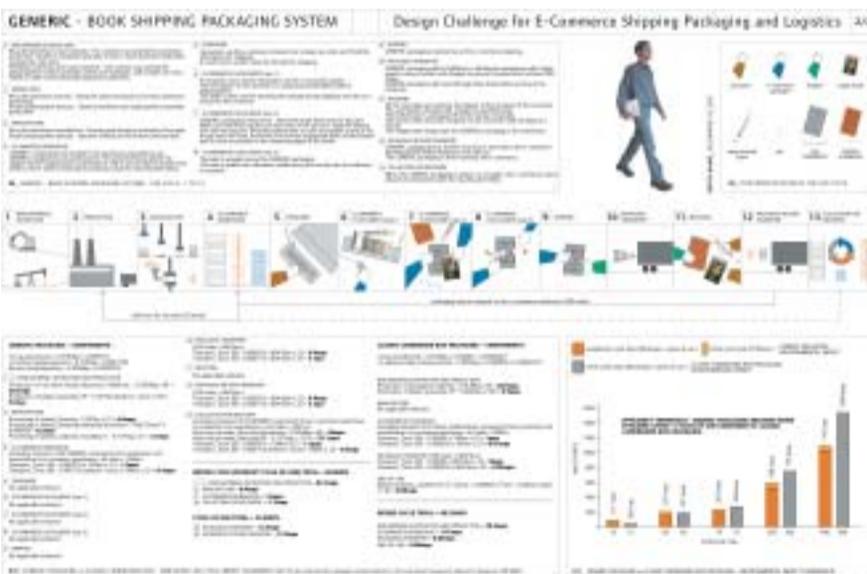
RECOGNITION OF INNOVATION



01_ FRONT VIEW



03_ OVERALL VIEW



NUTRIENT TYPE

- Technical Nutrient
 - Polypropylene and recycled aluminum
 - Water-based inks on polypropylene labels

RECOVERY STRATEGY

- Reuse
 - Product of service—packaging owned by the vendor and leased to and recovered by the shipper
 - Monetary deposit from shipper to vendor to ensure control on the flow of packaging and maximize recovery rates
- Recycling

DESCRIPTION

The Generic package consists of a re-usable and recyclable box for a single book. Each component is made of a single material—recycled aluminum and polypropylene—both of which are durable materials largely and easily recyclable. The top is made of recycled aluminum (Al). Semi-transparent polypropylene (PP) is used for the bottom. Those two parts snap together with round brackets and slits so that the top can fit the thickness of the merchandise. A system of snapped-pins assembled in the bottom part holds the book inside the packaging and protects it. Then, a recyclable polypropylene label printed with water-based ink is wrapped around the packaging for use as a bill, a receipt, and a safety seal.

The Generic concept promotes the re-use of the product until considerable damages prevent the packaging from fulfilling its function adequately. When this is the case, it is sent to the recycling plant where the materials return in the cycle of production to form a closed loop. In other words, the whole system creates a cyclical material flow.

The logistical system includes the existing distribution infrastructure. The only notable variation is the components of the packaging that are returned by the same delivery business to the warehouse in the e-commerce company. This involves modifications in the delivery trucks and the warehouses (spaces, compartments, etc.). A monetary deposit on each package, which implies that there is an agreement between the e-commerce and the shipping companies, ensures a tight control on the flow of packaging to ensure the highest possible rate of return.

JUDGES' COMMENTS

- Very well thought out entry with clear understanding of life cycle issues.
- Liked the fact that the box could be compressed to fit any size book(s).
- A very innovative system is offered, where the packaging is a product of service, and the shipper leases the packaging from the vendor.



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