



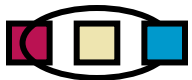
September 11, 2012



Sustainability:

Step 1 = Better Design

Kevin Howard
Consultant



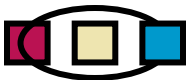
Thinking Inside, Outside and
Beyond the Box

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Thanks and Caveat

- IoPP
 - Hewlett-Packard
 - You
-

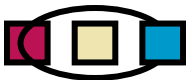
- Caveat: Many examples of electro-mechanical products, but all principles can and have been applied to CPG products





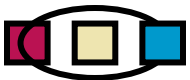
Discussion points

- Relationship between sustainability and costs
- Why density is the key to low impact and costs
- Key drivers to package size (and it's not simply bad package design!)
- Why field observations are crucial
- Examples of extraordinary savings in conjunction with reduced environmental impact



Who is Kevin Howard?

- Consultant, focused on distribution packaging and testing
 - Though real focus is reducing landed costs
- 2005: Packnomics is formed
- 1988 – 2005: HP inkjet printers: packaging, testing, procurement
- 1987 – 88: Consultant, including teaching in China
- 1984 – 87: Whirlpool Corp,: packaging engineer
- BS and MS degrees in Packaging (MSU). Internships at IBM and MTS Systems. Research and teaching assistantships at MSU.
- Chairman of ASTM D-999, Vibration Testing of Packaged Products, for 20 years
- Active member of ASTM, ISTA, IoPP

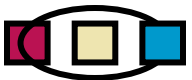




If Step 1 = Better Design
then

Design of What?

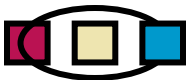
- Packages
- Products and components
- Test methods
- Material Handling techniques
- Supply chain architecture






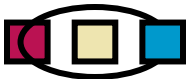
Carbon Footprint

- Simple metric:
 - Higher landed cost = higher carbon footprint
- Landed cost = all costs to produce and deliver a product to final customers
 - Shipping, storage, handling
 - Direct material
 - Inventory carrying costs
 - Taxes and duties
 - Damages

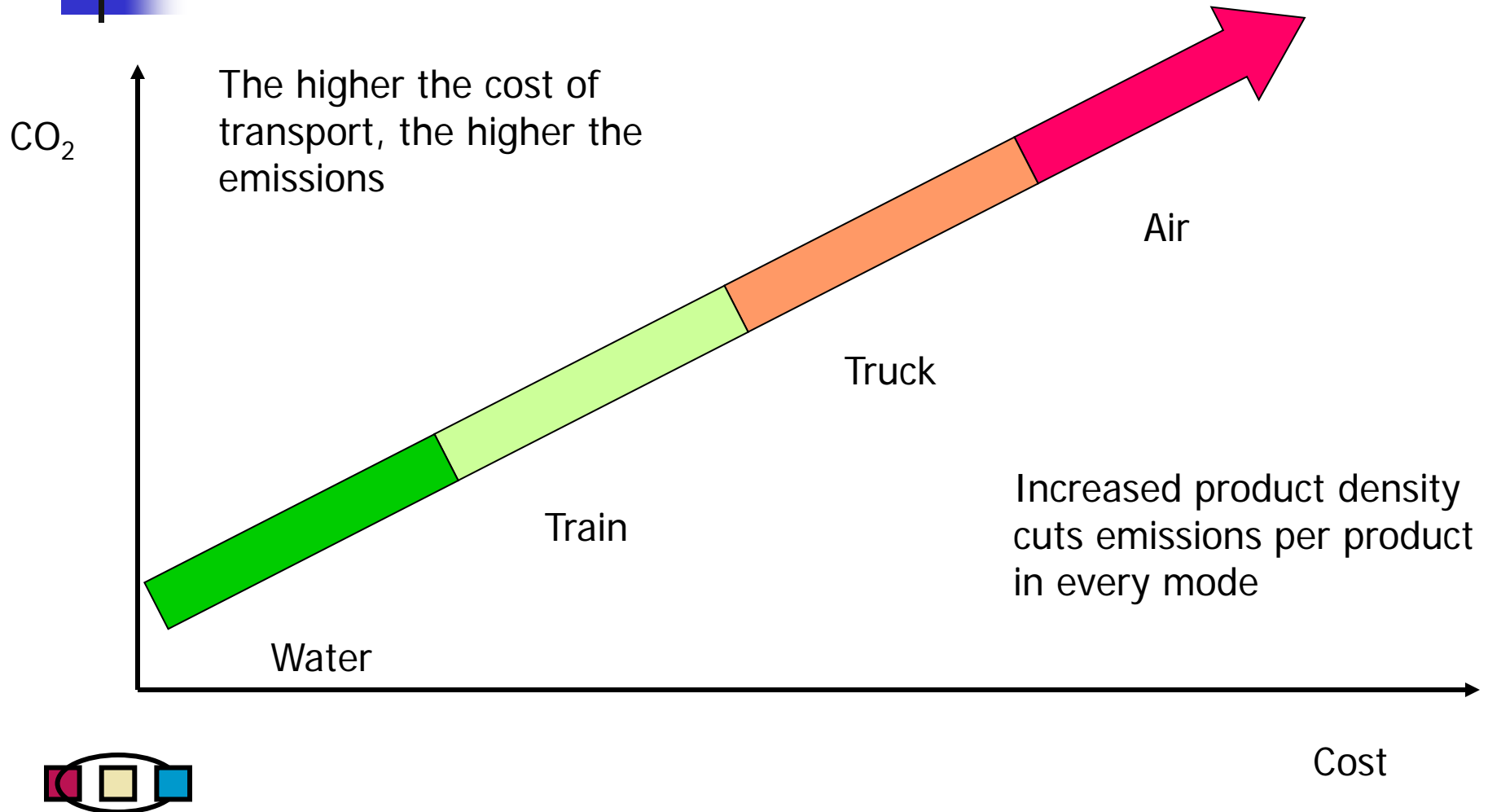


What drives landed costs and carbon footprint?

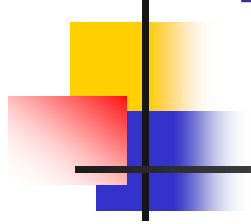
- 
- Mode of transport
 - Air, truck, train, water
 - Product density in each mode of transport
 - Damage rates
 - Packaging material choices
 - Weight of materials (packaging and product)
 - And about a million other details like distances shipped, inventory control practices, number of handlings, etc, but all are captured in landed cost



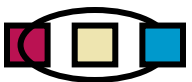
carbon footprint



Why is density important?



- As Willie Sutton, famous bank robber, used to say:
 - Because that's where the money is!
- Distribution logistics commonly cost 5 – 10 times packaging DM
- Shipping costs directly related to fuel costs
- Large and small companies alike manufacture and ship globally
 - All companies benefit from lower costs!
 - Get the biggest payback for your time and knowledge: focus on reducing logistics costs

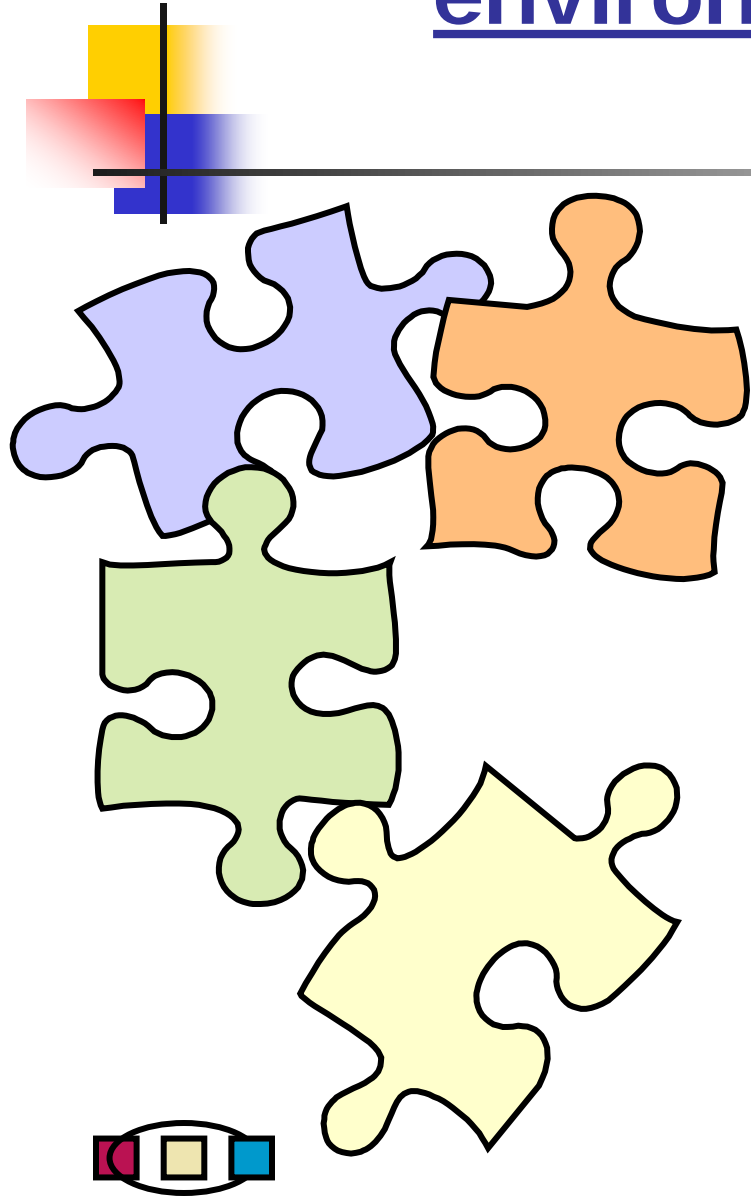


- As Sun Ra used to say, Space is the Place!

Space inefficiency and environmental impact

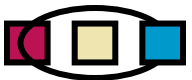
Wasted space:

- Excessive packaging
 - Comes from poor design, poor testing, poor knowledge of real hazards
- Pallets: inefficient use of surface and/or using pallets for international shipments
- Poorly considered product and component designs
- Little focus on total space utilization in transport
- Resulting in:
 - High shipping costs
 - Extra trucks, planes, pallets, packaging, handling and warehouses
 - Excessive environmental impact!



Why do many companies use too much packaging?

- Inappropriate test levels
- Packaging design invites poor handling
- Packaging applied at inappropriate point in supply chain
- Poor product design
- Management not aware of cost impacts due to design decisions
- Packaging process: designing from the inside out vs. the outside in





Design Process

Typical: Design from Inside  Outside

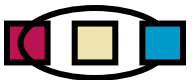
6-STEP METHOD (for cushioned products)

- 1. Define the environment**
- 2. Product Fragility Analysis**
- 3. Product Improvement Feedback**
- 4. Cushion Material Performance evaluation**
- 5. Package Design**
- 6. Test the Product / Package System**

Product + Package = Distribution Environment

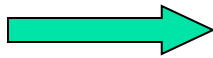
Lead to minimum packaging?

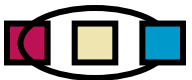
Fastest process to design best package?



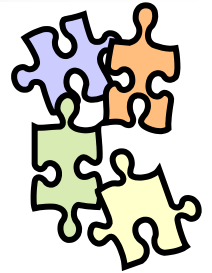


Pragmatic Design Process

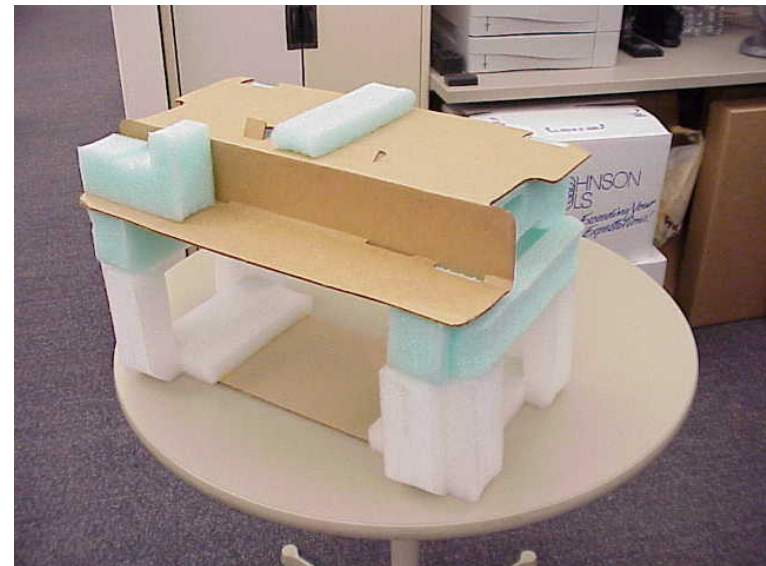
- Design from the outside  in
- Start with known sizing of transport modes
- Maximize pallet densities for in-region loads (No! Not everyone uses 48 x 40!)
- Minimum package size to hold everything = a cost. Anything larger increases costs. Show management!
- Conduct package tests with dummy product, refine design prior to testing expensive products
- Make product designers more responsible for fragility and geometry choices. Highlight to management cost implications.



Tests drive excess packaging



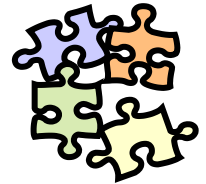
- Why did they need PE foam?
- Fragile product? Excessive damages? Exceedingly high value?
 - No, no, and no.
- Answer: too many **lab** drops

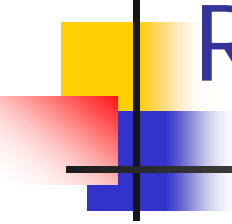




Bad tests = high costs

- Too harsh of tests = Excess protection
- Not testing to replicate actual field failures = higher damages
- Using standard tests from ISTA, ASTM, JIS, FedEx and others could cause both conditions
 - Shortcomings:
 - No two are the same
 - None test all orientations
 - Small number of units tested
 - may not replicate consistent failures in field
 - No design margin testing

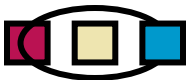
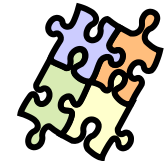




Reasonable tests = less packaging

- HP DeskJet package, changed to EPS
- Reducing number of drops per pack allowed for cheaper foam, even at increased height

- 1 material vs. 2
- EPS more readily recyclable
- Supplier gets densified beads vs. planks

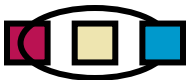


~~Steps to becoming a good packaging engineer~~

Steps to becoming a great un-packaging engineer

- Rule 1: Ask questions!

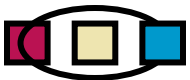
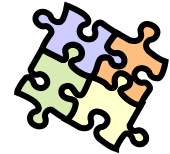
- Was test drop height reasonable?
- If test height decreased, how many more products would fit on a pallet?
- What business risk is there to reducing protection?
- How much money is saved if package could be reduced?



Appropriate tests = higher profits

(decreased drop height)

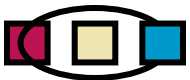
- Less packaging material = lower DM
 - Smaller box = jump from 32 to 50 units/pallet = 56%
 - Higher density = fewer pallets, warehouses, labor, trucks (606 TL vs. 947/month)
 - Minimized risk exposure...no increase in damage rates
 - Significant reduction in materials to recycle or landfill



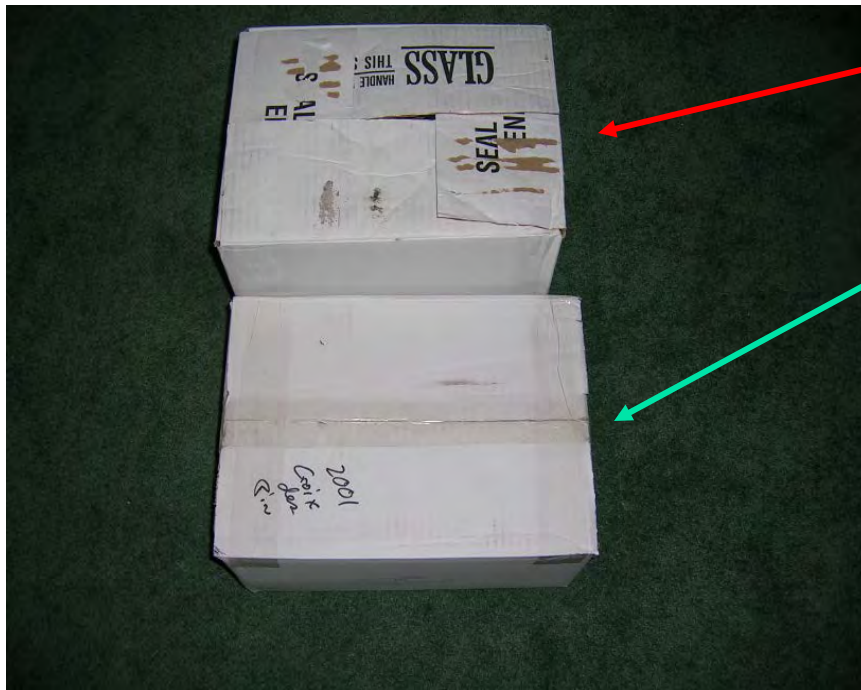
Product geometry impacts costs



- 2 wine boxes
- Each with 12 bottles
- Each with the exact same amount of liquid



Product geometry influences box size and shape

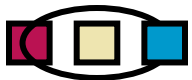


US box

French box

Bordeaux style bottle

Burgundy style bottle



Product geometry influences box size and shape

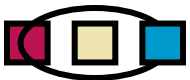


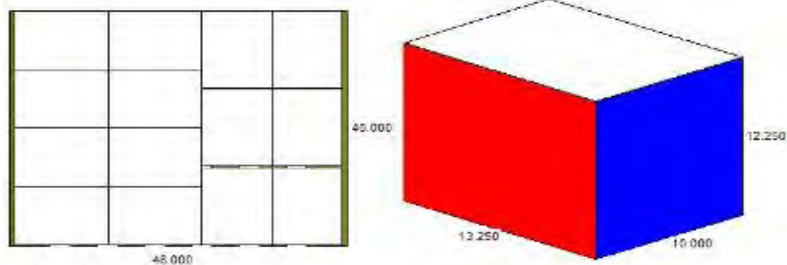
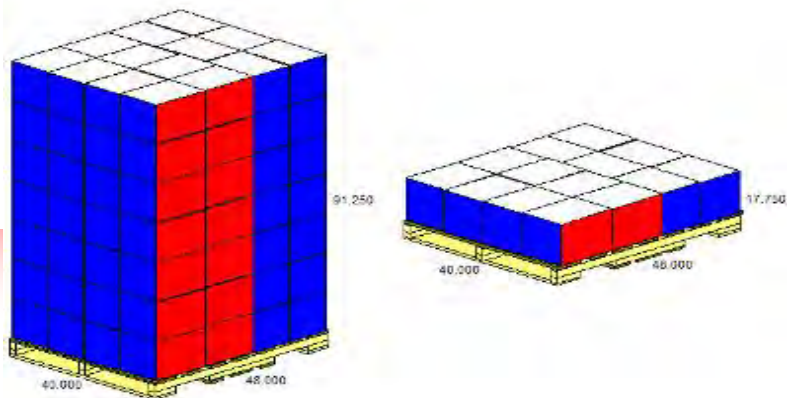
US box fits US pallets, but...

- Wastes space
- Uses excess materials
- Not well suited for international shipment

French box is more efficient...

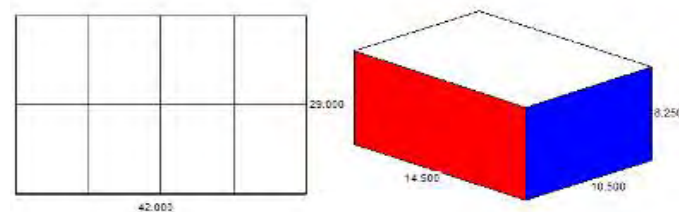
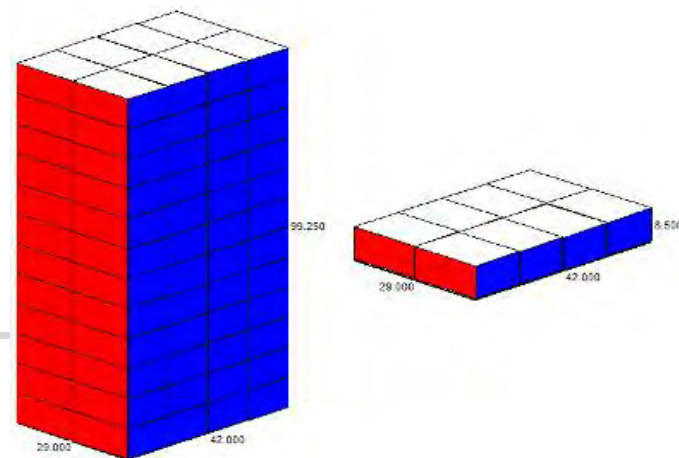
- Less dead space
- Minimal materials
- Perfectly sized for international distribution





US boxes on pallet

- 14 cases per layer
- 7 layers
- 21 footprints per OC = 24,696 bottles



French boxes on slip sheet

- 8 cases per layer
- 12 layers per footprint
- 33 footprints per OC = 38,016 bottles

54% delta!

Plus; reduced weight of box,
pallet and glass



Component packaging (bearings)

Critical, sensitive interior
edge



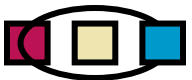
Damaged in in-bound,
loose pack boxes



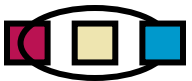
Component packaging (bearings)



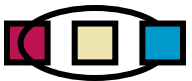
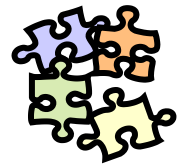
Male feature nicks
critical edge



Initial reaction: protect with packaging



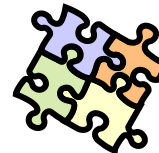
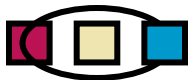
Packaging: increased material, labor, transport, waste, slowed production, still had damages



The (un)packaging solution: better design (reduced top feature diameter by 0.4 mm)



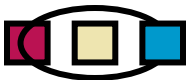
- Self stacking
- Self nesting
- Self protecting
- Self presenting
- Lego mindset: Has been done with stamped sheet metal, injection molded plastics, molded foam
- Design beyond product functionality!



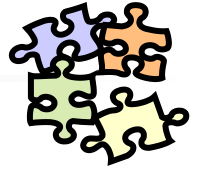
LTL problems



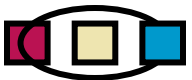
- Large flats carried into truck one at a time
- Leave manufacturing site as full trucks to LTL cross docks
- Large flats do best standing on edge



Arrival at customer site



- The packaging invited this type of handling!
- Don't fault the material handlers!
- In uncontrolled handling environment, is it possible to control the handling?
- Must packaging protection be increased for this environment?





The packaging fix

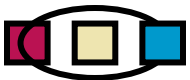
- Place everything into a second box with PE edge cushions
- Company believed they were relegated to more packaging
- Cost of extra packaging: \$750,000/year
- Increased shipping costs based on size
- Cost of damage: high cost and customer dissatisfaction





What's wrong with this package?

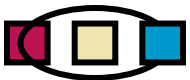
- Large flats provide little center panel support
- Individual packages assured every piece would have opportunity for mis-handling multiple times
- Large flats require extraordinary amounts of expensive corrugated
- Product was fragile to bending and impact
- Product is strongest when on edge, but packaging didn't assure orientation in transit
- Cushioning needed to protect from drops.





Questions lead to solutions

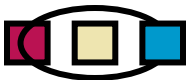
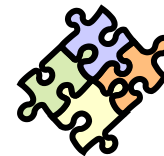
- If products do best on edge, then how could this be accomplished?
- If manual handling leads to drops and mis-orientation, how can this be rectified?
- Instead of adding more packaging to protect from handling that the packaging invited, is it possible to enforce more benign handling?
- If there were no drops and no mis-orientation, then how much packaging would be needed?



Change the package to change the handling



- Reduce packaging in half
- Avoids \$750,000 extra packaging
- Requires mechanized material handling...much more benign than manual handling!
- No more drops or crushing
- Most importantly: Assures product stays upright



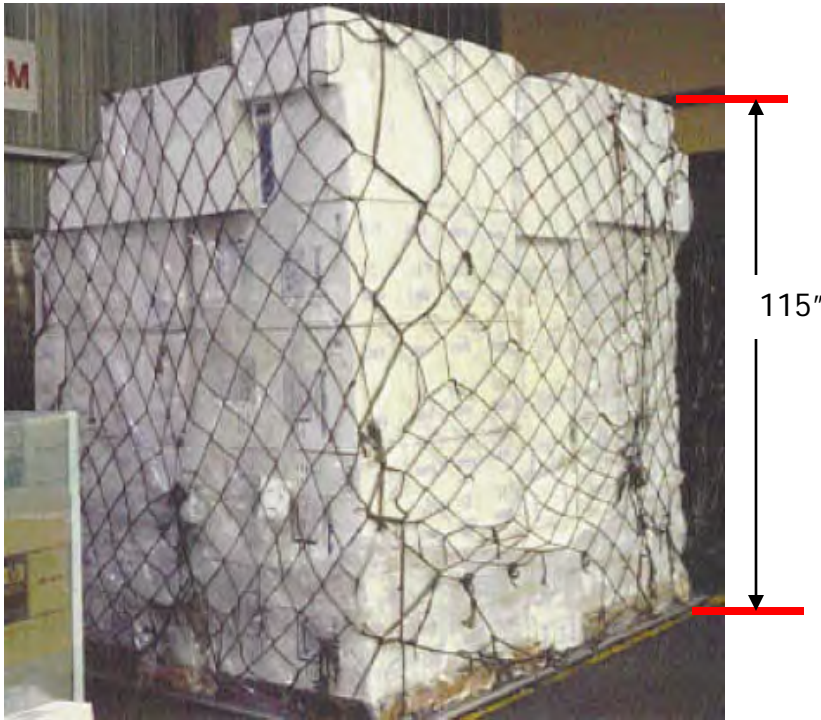
Packaging inviting damages



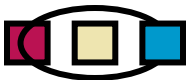
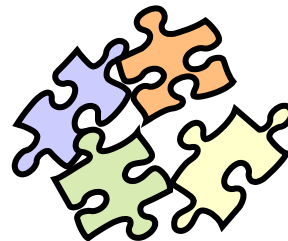
- 32 per US pallet
- 100% air ship
- Designed for distribution?



Air shipment problems

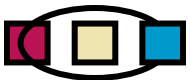


- Boxes taken off pallets – US pallets don't fit cookie sheets
- How did they stack to 115"?
- How did they un-stack in Germany?
- New pallets needed on arrival.
- High percent of boxes needed replacement.
- Half of boxes needed to change country option.

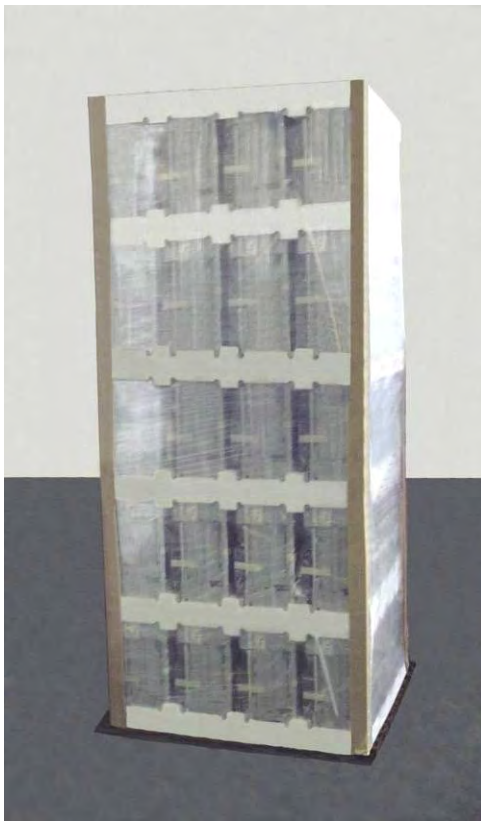


Different situation, similar questions

- What would stop individual handling abuse?
- How could damages be reduced?
- How could distribution costs be reduced?
- How could product differentiation be accommodated more cost effectively?



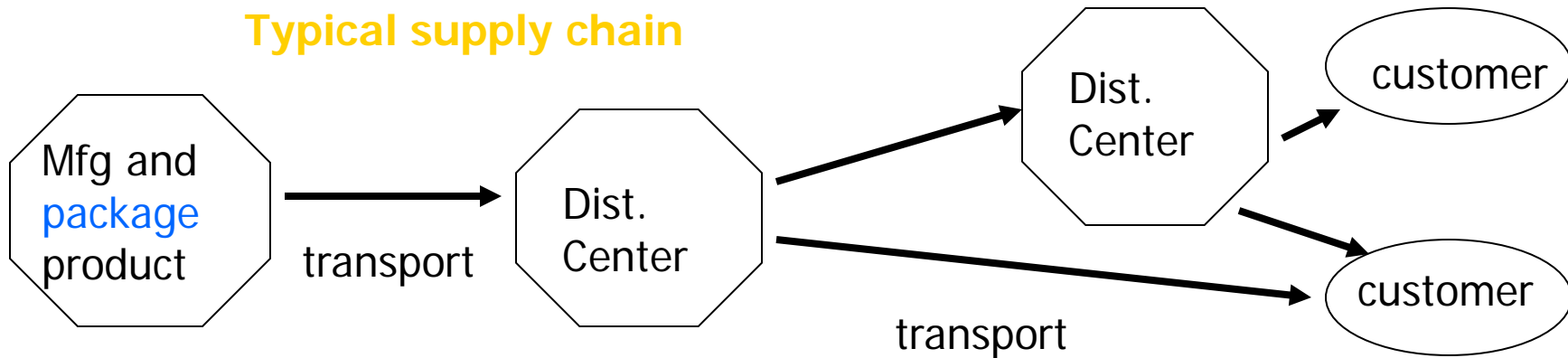
Less damage with less packaging: packaging and product differentiation postponement



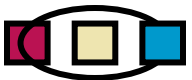
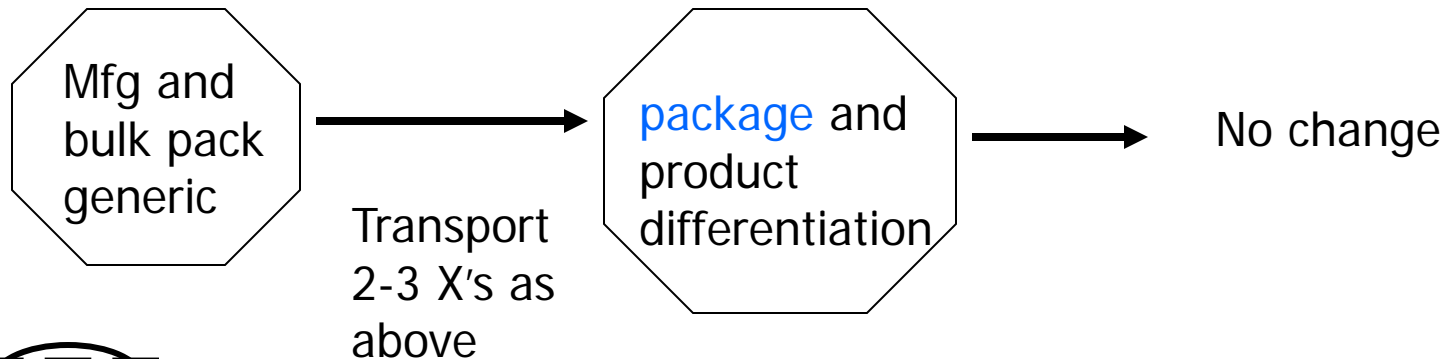
- **Eliminate cushion, box and accessories**
- **Enforced unitization requires mechanical handling, thus eliminating free fall drops**
- **Replace wood pallets with slip sheet**
- **Inherent strength of product is incorporated into packaging design**
- **Dim-weight limit is crossed, allowing to pay by weight**
- **Footprint and height are tuned to mode of transport**
- **With no fluff space, exact maximum dimensions can be calculated for future products.**

Supply Chain Architecture

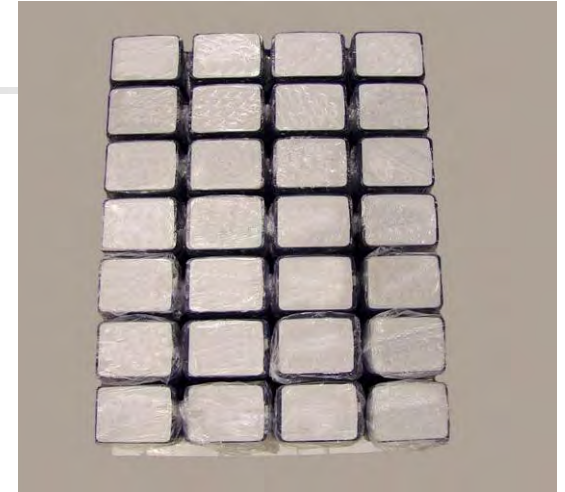
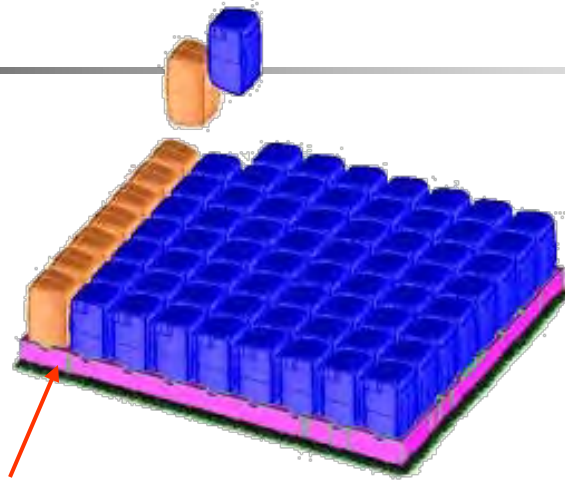
Typical supply chain



Postponement supply chain

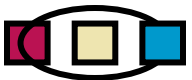


Postponement details

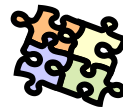


Packaging costs increased, but...

- Distribution costs (and number of planes) dropped in half
- Box damage, costing \$400,000, dropped to \$0
- Product damage dropped to 0.01%
- Inventory levels of expensive printers decreased dramatically, while fulfilling orders on time increased



Carbon footprint



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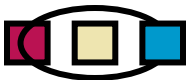
Match package to system

- Samsung refrigerator packaging
- Corrugated + EPS for all customers worldwide. Everything shipped from Korea.
- Big boxes are expensive
- EPS is cheap, but fractures and provides limited protection
- If focus only on customers in Korea, could costs be reduced?
 - Customers in Korea are close to manufacturing
 - Samsung controls delivery
 - 80% of population in high rises, all packaging collected and recycled



Evolutionary vs. revolutionary

- Yes, could reduce costs and environmental impact by replacing boxes with shrink wrap, but...
- Why have same package for Korean customers as for customers overseas?
- To reduce impact, using less throw away material is good, but using none is better.



Introducing...The first-ever returnable home appliance package system!



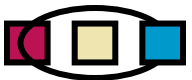
- Using more expensive but re-useable material provides better protection, lower damage rates, and lower environmental impact.
- Expanded polypropylene
- Hoping for 40 trips
- Eliminated throw away corrugated and EPS
- Saves 130,000 trees annually
- Reduces CO2 emissions by 7000 tons/yr
- Savings = \$10 million!
- Savings to expand with future products





Re-define your job!

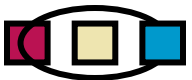
- Is your job to design packaging,
 - *or* to figure out how to get products from point A to point B at the lowest cost with acceptable levels of damage?
- Do you want excessive packaging to survive bad handling,
 - *or* limited packaging that encourages more benign handling?
- You were hired to design packaging,
 - *but* your knowledge can be extended to product design, testing, material handling and supply chain to contribute more



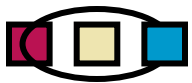


Summary thoughts

- Protective packaging materials can highlight product design flaws/opportunities
- Designing from the outside in allows for lowest cost analysis
- Direct observation of distribution system is imperative for good testing and design
- Space costs money...minimize it!
- Maximizing load density is vital to minimizing environmental impact

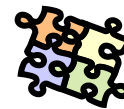


Go forth and prosper package!



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Space is the place!
Solve the puzzle!





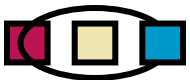
Thanks for your attention!

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