OPEESA
Packaging Workshop

Jack Ampuja
Supply Chain Optimizers
Niagara University
What Do We Do?

• Utilize both sophisticated computer models and years of practical experience
• Synchronize the relationship of shipping containers, warehousing & transportation to achieve lowest total cost for clients
• We always out-perform corrugated manufacturers that focus only on the box
• SCO - independent service with only goal to make our clients more efficient
Optimization Opportunities

• Traditional manufactured product
  • Multiple units of the same product in a box

• Imported product – especially from Asia
  • Little application of packaging science

• Pick-pack operations in e-commerce
  • Many ship 1 million+ combinations of weight & cube each year
Process Evolution

• Traditionally driven by efficiency gains
  - reduced packaging, handling labor, storage & transportation expense

• Today many clients want to document sustainability impact
  - must report to shareholders & consumers

• In-line with Supply Chain goal of increasing performance while reducing costs
Impact of Pallet Patterns

<table>
<thead>
<tr>
<th>Interlock?</th>
<th>Overhang?</th>
<th>Box Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>No</td>
<td>100%</td>
</tr>
<tr>
<td>No</td>
<td>Yes</td>
<td>68%</td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
<td>55%</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>51%</td>
</tr>
</tbody>
</table>
Stacking Strength

• Interlocked pattern gives better stability but 40% less compression strength than column stacking
• 75% of box compression strength is located in 4 corners of container
• One inch misalignment of box corners reduces compression strength by 43%
Impact of Storage Time

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>0 Days</td>
<td>Full Strength</td>
</tr>
<tr>
<td>1-4 Days</td>
<td>70%</td>
</tr>
<tr>
<td>Up to 11 Days</td>
<td>65%</td>
</tr>
<tr>
<td>Up to 31 Days</td>
<td>60%</td>
</tr>
<tr>
<td>Up to 101 Days</td>
<td>55%</td>
</tr>
<tr>
<td>Up to 1000 Days</td>
<td>50%</td>
</tr>
</tbody>
</table>

*in normal ambient temperature space*
# Impact of Humidity

<table>
<thead>
<tr>
<th>Relative Humidity</th>
<th>Box Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>45%</td>
<td>110%</td>
</tr>
<tr>
<td>55%</td>
<td>100%</td>
</tr>
<tr>
<td>65%</td>
<td>90%</td>
</tr>
<tr>
<td>75%</td>
<td>80%</td>
</tr>
<tr>
<td>85%</td>
<td>70%</td>
</tr>
<tr>
<td>100%</td>
<td>50%</td>
</tr>
</tbody>
</table>
## Supply Chain Optimizers

**ORDER BY 6 PM FOR SAME DAY SHIPPING**

**200 LB. TEST**

**OVER 1,300 STOCK SIZES**

**OVER 2 MILLION BOXES SHIPPED EVERY DAY!**

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### 20 BEST SELLING BOXES

<table>
<thead>
<tr>
<th>MODEL</th>
<th>INSIDE DIMENSIONS</th>
<th>PRICE PER BOX</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L x W x H</td>
<td>25</td>
</tr>
<tr>
<td>S-4052</td>
<td>6 x 6 x 6&quot;</td>
<td>$0.41</td>
</tr>
<tr>
<td>S-4080</td>
<td>8 x 6 x 4&quot;</td>
<td>$0.48</td>
</tr>
<tr>
<td>S-4084</td>
<td>8 x 8 x 8&quot;</td>
<td>$0.59</td>
</tr>
<tr>
<td>S-4103</td>
<td>10 x 8 x 6&quot;</td>
<td>$0.63</td>
</tr>
<tr>
<td>S-4105</td>
<td>10 x 10 x 10&quot;</td>
<td>$0.83</td>
</tr>
<tr>
<td>S-4406</td>
<td>12 x 9 x 6&quot;</td>
<td>$0.76</td>
</tr>
<tr>
<td>S-4213</td>
<td>12 x 12 x 4&quot;</td>
<td>$0.84</td>
</tr>
<tr>
<td>S-4130</td>
<td>12 x 12 x 6&quot;</td>
<td>$0.88</td>
</tr>
<tr>
<td>S-4124</td>
<td>12 x 12 x 8&quot;</td>
<td>$0.98</td>
</tr>
<tr>
<td>S-4125</td>
<td>12 x 12 x 12&quot;</td>
<td>$1.74</td>
</tr>
<tr>
<td>S-4142</td>
<td>14 x 14 x 14&quot;</td>
<td>$1.61</td>
</tr>
<tr>
<td>S-4163</td>
<td>16 x 12 x 12&quot;</td>
<td>$1.42</td>
</tr>
<tr>
<td>S-4166</td>
<td>16 x 16 x 16&quot;</td>
<td>$1.93</td>
</tr>
<tr>
<td>S-4181</td>
<td>18 x 12 x 12&quot;</td>
<td>$1.32</td>
</tr>
<tr>
<td>S-4183</td>
<td>18 x 14 x 12&quot;</td>
<td>$1.60</td>
</tr>
<tr>
<td>S-4185</td>
<td>18 x 18 x 18&quot;</td>
<td>$2.32</td>
</tr>
<tr>
<td>S-4201</td>
<td>20 x 20 x 20&quot;</td>
<td>$3.02</td>
</tr>
<tr>
<td>S-4243</td>
<td>24 x 12 x 12&quot;</td>
<td>$1.68</td>
</tr>
<tr>
<td>S-4340</td>
<td>24 x 18 x 18&quot;</td>
<td>$3.14</td>
</tr>
<tr>
<td>S-4247</td>
<td>24 x 24 x 24&quot;</td>
<td>$4.30</td>
</tr>
</tbody>
</table>

- BALE QTY: 25 / 500, 25 / 500, 25 / 500

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**LARGEST SUPPLY OF STOCK BOXES IN THE COUNTRY**

**200 LB. TEST**

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**IN STOCK - SHIPS TODAY**

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- **SHIPS VIA MOTOR FREIGHT**
Inadequate Assistance

Major US “Shipping Supply Specialist” with catalogue business shipped from 6 DCs

- Catalogue lists top 25 best selling boxes
  - 11 are cubes, 9 are squares
- Cubes and squares are always more expensive to construct and bad choices for distribution due to bad pallet & truck fit

...more seller profit, more user cost
## Pallet Differences

### Original
- Count: 50 cases
- Overhang: 1.3”
- Stacking strength
  - 1.1 pallets high
- Truck loading
  - 100/floor spot with machine loading..110 with hand stacking

### Optimized
- Count: 60 cases
- Overhang: .7” & .5”
- Stacking strength
  - 2.1 pallets high
- Truck loading
  - 120/floor spot with machine loading
Optimization Results

• 16% reduction in freight & warehouse cost
• Better stacking strength: less damage
• Less overhang on pallet
• No hand stacking needed on full truck loads
• Can be positioned as a customer benefit as their logistics costs will decline too
• Major ‘green’ improvement
American Retailer – Towels

- 6 in one bag x 2
- Carton Dimension (ID): 17”x16.5”x7”
- Carton Piece Count: 2

Suggested Carton Dimension

- Carton Dimension (ID): 17.125”x12.125”x7.75”
- Carton Piece Count: 2

22.08% Savings*

Recommended Carton/Stacking

- Change case pack arrangement to rotate towel dimension vertical
- 18% less material in new box

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R G Barry

• $125 M footwear supplier with no profit
  • In danger of missing loan repayment
  • Sourcing from Mexico & China

• Used packaging optimization to increase payload of ocean containers
  • Reduced costs $2.8 M

• Gained business increase of $10 M from Walmart and $5 M from Target
Operational Approach

• Modest changes to shipping cartons
  • Eliminated internal air
  • Balanced complexity & efficiency
  • Enabled column stacking which is stronger

• Bigger changes to inner packs
  • Increased Walmart count from 12 to 18 pairs
R.G. Barry Corporation

Present

<table>
<thead>
<tr>
<th>Load Ref.</th>
<th>Carton / Case</th>
<th>Cube Used</th>
<th>Area Used</th>
<th>Pallet Type</th>
<th>Truck Solution Ref.</th>
<th>Truck Area Used</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6</td>
<td>912</td>
<td>96.0 %</td>
<td>800X40</td>
<td>10160</td>
<td>62.9 %</td>
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<td></td>
<td>19</td>
<td>112</td>
<td>93.6 %</td>
<td>500X50</td>
<td>20100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>152</td>
<td>96.6 %</td>
<td>600X40</td>
<td>20160</td>
<td></td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>460</td>
<td>86.6 %</td>
<td>500X50</td>
<td>4410</td>
<td></td>
</tr>
</tbody>
</table>

Future

<table>
<thead>
<tr>
<th>Load Ref.</th>
<th>Carton / Case</th>
<th>Cube Used</th>
<th>Area Used</th>
<th>Pallet Type</th>
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<th>Truck Area Used</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15</td>
<td>1006</td>
<td>96.0 %</td>
<td>800X40</td>
<td>10160</td>
<td>62.9 %</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>112</td>
<td>93.6 %</td>
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<td></td>
</tr>
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Taking Control of Process in Asia

Today, provided supplier:
- Product Specification
- Retail Packaging Specification

Tomorrow, provided supplier:
- Product Specification
- Retail Packaging Specification
- Carton Specification
- Inner Pack Configuration
- Container Load Diagram

This change was “phased in” and required technology configuration.
✓ Executive sponsor is critical to accelerating success.

✓ Recognize organizations true core competencies.

✓ Overcome “We can do this internally” skeptics.

✓ Strong & flexible supply chain partnerships facilitate savings.

✓ “Speed to Value” is an attitude!

✓ Data integrity is critical (quality of the item master file).

✓ SCO supports post-implementation.
Welcome Addition Kit

• Combination box of disposable diapers, cans of baby formula, shampoo, wipes
• 11 varieties: varying product counts
  • all used same master shipper
• Optimized solution: 3 different shippers
• Savings was $1+ million in material
  • Plus $2M in warehousing & freight
Welcome Addition II

- Marketing had choice of four alternatives for refreshed master shipper
- Pre-commitment packaging optimization identified the following:
  - two middle alternatives had similar cost
  - high/low had $.75/unit difference
- With 1.5 million units shipping, cost swing was $1+ million in material alone
Distributors

• Number of companies with at least 10% of total revenue from e-commerce grew 8% from 2014

• The primary objectives among distributors for e-commerce remain:
  • acquiring new customers
  • enhancing their company brands
  • improving the user experience

• A quarter of US distributors receive 50% or more of their orders by email
  • Many manufacturers also dabbling in e-commerce
E-commerce Growth

• U.S. e-commerce sales in 2016 = 7.5% of total retail sales
  • +7% over 2015 to $325 billion
  • +1.7% increase in total retail sales
  • When gasoline and restaurants are excluded e-commerce is now ~10% of US retail sales

• Amazon merchandise sales +21% in 1st quarter 2016
  • Shipping cost + 42%
  • Spent $1.45 billion more on shipping in the quarter than what was paid by customers
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Why is this Happening?

• Small package shippers used to be large sophisticated companies like
  • LL Bean...mail order
  • Ford...auto parts
  • John Deere....tractor parts

• They shipped many packages daily to limited destinations
  • Primarily business to business
E-Commerce Financials

• Shipping staples like toilet tissue or RTE cereal to rural areas is a loser
• Tide pods [$10.99 retail]
  • In-store profit: $3.02 [27%]
  • E-commerce loss: $12.25
• Christian Dior mascara [$28.50 retail price]
  • In-store profit: $10.69 [38%]
  • E-commerce loss: $3.86
• These kinds of pricing problems cannot be overcome with volume...there isn’t any

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Dim Weight Impact

• **Ampuja in 2015:** *Dim weight billing can add as much as $1 billion in annual shipping cost*

• Sealed Air survey of 150 customers found majority—nearly 89%—already seeing an increase in shipping costs due to changes in dimensional weight shipping policies
  • 41% report increases of 10% or more

• **Ampuja & Kling of Niagara University completed dim weight survey & article for DC Velocity magazine**
  • Lots of mis-understanding by shippers...many not sure of what to do....some do nothing but pay higher costs
Oversize Packages

• Major inefficiency: large boxes do not fit material system - must be processed manually
• UPS eliminated discounts on these large boxes due to extra costs
• New cost: $57.50 [oversize charge] + 90 lb rate
  • Total cost = $100/ box
  • Will apply to bicycles, barbecues, furniture, luggage
• New cost went into effect in late 2015
Some Pick-Pack Clients

- Clarks Companies, footwear
- Toys-R-Us, toys
- Mac’s Antique Auto, auto parts
- Newark-in-One, electronic parts
- Brookstone, specialty retail
- Lillian Vernon, mail order
- Fisher Scientific, laboratory supplies
- John Deere, tractor engine parts
- Batteries Plus, batteries
- Office Depot, office supplies
Least Sophisticated

• Totally manual process
  • Order packer selects shipping case based on experience & observation
  • Limited number of boxes...usually 6 max
  • Packer selects wrong box 25% of time

• Redesign of shipping cases to be more efficient and less costly is possible but....

• Total improvement opportunity is minimal
Improvers

• Manual operations wanting to move down in cost [and up in sophistication] can be helped

• Computer aided box selection software can work with any order processing system

• User must build a data base of item weights and cubes for system to work
  • but solution is permanent
  • Many shippers are unwilling to spend money therefore cannot cut costs or improve operations
Software Advantage

• Sophisticated shippers – Office Depot, Target, Toys-r-Us, Walmart have computer aided box selection software
  • WMS knows weight & cube of each item and selects best box based on total weight & cube going into box
• Typical savings is 10% cost reduction which is $1 million + saving for large shipper
• Used to require major investment in ERP
  • Now available as standalone less costly system
E-commerce Client #1

• 13K SKUs - 6 million cartons/yr outbound
• Packaging optimization delivered:
  - 8% reduction in cartons shipped
  - 15% reduction in cube
  - 14% increase in density
  - 20% reduction in packing materials
  - 14% reduction in freight
E-commerce Client #2

• 13K SKUs - 2 million cartons/yr outbound

• Packaging optimization delivered:
  - 10% reduction in cartons shipped
  - 15% reduction in cube
  - 14% increase in density
  - 27% reduction in packing materials
  - 13% reduction in freight: 200 fewer trucks
More Thoughts...

• Pick-pack packaging issue is that distributors usually carry 1,000’s of products
  • Operation will ship over one million combinations of weight & cube each year
  • We have seen operations with 4+ million combos

• Evaluation for one pick-pack client required evaluating 400 different boxes against 2 million unique shipments per year
  • 800 million analyses
  • This kind of analysis cannot be done w/o software
  • Manual effort can deliver 50,000 analyses in one year
    • Will require 20 years to do one million evaluations
Dim Weight Solution

Only two paths

• Negotiate rate relief from carriers
  • Carriers have outstanding data and strong bargaining position

• Make shipments more efficient
  • Employ dimensioner for data
  • Install computer-aided box selection software
  • More boxes are better...optimal ones are best
Packaging Lessons

• Transportation cost must be #1 consideration
  • Much higher than warehousing or packaging
• Do not leave package decision to Asian partner
• Always avoid square & cube boxes
  • They use more material than rectangles and are not good fit for logistics
• Use column stacking in warehouse
  • Provides much better strength than interlock
Summary

• Excellent opportunity for supply chain efficiency & sustainability improvement
• Real $ & environmental benefit is in freight
• Typical cost reduction opportunity:
  - 10% for manufacturers/inbound
  - 15% for pick-pack companies
• Process is over-looked by most firms
Closing Thought

“The greatest obstacle to discovery is not ignorance....it is the illusion of knowledge.”

- Daniel J. Boorstin: 
  author, historian, Librarian of Congress