



**MIT** Center for  
Transportation  
& Logistics

## Innovations in Transportation: Focus on Procurement and Management

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## Executive Summary

These notes summarize the Center for Transportation and Logistics (CTL) symposium on Innovations in Transportation held at MIT on April 27-28, 2004. The conference was attended by more than 80 professionals from the shipper, carrier, software, and research industries.

The objective of the symposium was to stimulate thought on where the current state of research and practice is for transportation. Seven presentations were made ranging from a panel discussion of procurement software vendors to individual presentations on global transportation issues. Discussion and debate amongst the attendees was lively and is captured in these notes.

While the remainder of this report details the specific discussions, the three major themes that surfaced should be highlighted. The first theme is the importance of **linking strategic planning to operational execution to manage uncertainty**. Software vendors and carriers alike noted that transportation procurement auctions conducted without considering operational realities are doomed to failure. Uncertainty in demand, supply, and network stability is only increasing. Shippers and carriers need to continue to explore methods of forming more robust (bullet proof) routing guides as well as incorporating more flexible contracting options to handle uncertainty.

The second theme is idea that while beneficial in many situations, **complexity of design comes at a cost**. Several shippers noted that while there are many opportunities to design a highly optimized transportation strategy (using continuous moves, cross-docking, etc.), the cost of actually operationalizing these highly complex concepts is often ignored in the analysis. One participant noted that simplicity is something to strive for in all planning engagements. The key take away is not to remove all complexity, but rather to balance the benefits with the added cost of managing it.

The third major theme is that **trade-offs between cost/service are best made between all players**. While the phrase collaboration turned into a cliché in the late 1990's, the recent changes in driver rules and economic conditions appear to be the final push needed to get shippers and carriers to work more closely together. Carriers are finally applying discipline in their decisions of which freight they should handle based on its economics. Shippers need to recognize this and work closely with them to ensure that the right freight is awarded to the right carriers. Information sharing, visibility, and increased standardization all contribute to lower total costs for all players.

**ACTION ITEM:** MIT's Center for Transportation and Logistics (CTL) is actively researching how shippers and carriers can improve how they work together. A focused research group on 'Innovations in Transportation' has been formed, headed by Dr. Chris Caplice. Please contact him directly if you are interested in participating in this group or if you would like to learn more ([caplice@mit.edu](mailto:caplice@mit.edu) or 617-258-7975).

The remainder of this documents reports on the details of the symposium. The next section expands on and discusses the major themes. The final section provides individual summaries of each presentation.

## Themes and Discussion

Across the seven presentations and audience discussion, several themes emerged. These themes include the impact of a dynamic business environment on transportation procurement, widely-recommended key solution elements, critical trade-offs in the procurement decision process, major challenges to continuous improvements to the quality and price of transportation, and thoughts on the future of transportation procurement.

### 1. The Changing Environment

Transportation occurs in a dynamic context. Optimizing the transportation function, then, requires respecting the changing context of economic, regulatory, technological, and business conditions. Key changes that affect transportation include the following five elements.

#### 1.1. Economic Business Cycle

The past year saw a tightening of the transportation market. As the economy enters an expansion phase, greater volumes of business mean greater volumes of transportation. Unfortunately, two current trends have squeezed carriers and limited capacity growth. First, rising prices for fuel and insurance have dramatically increased carriers' costs. Second, continuing price competition in retail and manufacturing create strong incentives to hold down transportation costs. As a result, large carriers refuse to expand and small carriers are entering bankruptcy in record numbers. The resulting constraints on capacity bode ill for the 2004 holiday freight surge.

Fully 50% of those surveyed by Bear Stearns thought the truckload market was either "tight" or "extremely tight" in the third quarter of 2003. Even so, Frito Lay suggested that more could be done to maximize the load in each truck and to reduce empty-miles. As it becomes a carrier's market, shippers will do more to improve the attractiveness of their freight. This includes improving how drivers are treated when they arrive to drop-off or pick-up a load.

#### 1.2. Hours of Service (HOS) Regulations

On January 4, 2004, the U.S. implemented new regulations to reduce the number of fatigue-related trucking accidents. The changed rules ensure that truck drivers sleep for appropriate durations at appropriate intervals. Changes in the rules for the on-duty and off-duty clock create a massive change in how drivers can drive. Because short breaks in driving no longer count as off-duty time, drivers use up valuable on-duty driving time while waiting for open docks, unloading, loading, and hookup. The realities of the new rules limit the maximum distance that a single driver can consistently drive every day to only about 450-500 miles.

The changes pose a challenge for virtually all companies, but especially manufacturers, retailers, and distributors. P&G, for example, noted that 50% of its loads involve a live unload. Under the new HOS rules, carriers are likely to change their policies, turning down loads that involve delays or multiple stops and increasing the use of detention charges.

J.B. Hunt estimated that Hours-of-Service (HOS) regulations would decrease freight velocity by 8% by limiting the miles-per-day averages of driver. Hunt mitigated the impact of this by turning down multi-stop shipments. Shippers also changed their behavior, reducing the frequency of live pickups and unloads by about 8% and accelerating unloading time of remaining live unloads nearly 6%. Overall, Hunt has seen only a 4% decrease in freight velocity due to HOS rules.

### **1.3. Ever-Changing Networks**

Transportation models contain a convenient fiction -- that shippers and carriers have predictable, static patterns of freight movements as the basis for optimization. If a carrier has high volume flowing into Atlanta and gets the opportunity to bid on freight leaving Atlanta, the carrier will bid aggressively to help balance the flow of trucks into and out of Atlanta.

But between the bid and the award, much can change. Consider the situation of the carrier who bids low to gain backhaul revenues out of Atlanta in an effort to balance its network. That carrier may win that outbound business but still have an imbalanced network by the time the loads are ultimately tendered. If the Atlanta inbound volume changes, the carrier's low bid on outbound Atlanta freight no longer makes economic sense.

Temporal mismatches between inbound and outbound freight patterns can also degrade the carrier's ability to balance their network. Although they may be able to approximately match inbound and outbound flows on a weekly or monthly basis, imbalances on a daily basis or intra-week basis mean a mismatch between the delivery of the inbound loads and the tendering of the outbound loads.

Prolonged procurement cycles exacerbate this problem. During the months between the original RFQ and the start of the new routes, much can happen. The less time between the bid and the award, the better for both shippers and carriers. AMR estimates that the average bid-to-award time is four months, a cycle time that is still too long in Hunt's opinion. Some companies, such as P&G, try to hold that time as short as two months, but participant comments suggest that times can be much longer than that.

### **1.4. Global Flows**

Many presenters cited rising global trade as an ongoing change in transportation. This included increased freight movement from low-cost producer nations and increased transportation within regions such as Asia. A Boeing-sponsored study of air freight found particularly high growth rates within China, within Asia, and between Asia and the U.S. and Europe. Latin America was another area of increasing trade. The expansion of the EU to 25 countries and on-going pan-European integration means increased transportation and trade within Europe. Schneider noted significant opportunities for combinatorial bidding for transportation procurement on the continent.

Global trade is expanding to include smaller and smaller participants. For example, some third parties are offering new services that will aid international shipping, and in particular enabling SMEs (Small and Medium-size Enterprises) to sell products internationally. These services help bundle the complexities of international shipping and creates a virtual local point of presence

with a domestic return address and domestic delivery labeling. Amazon noted the rise of global trade even at the consumer level. More consumers in each country are buying from non-domestic outlets of Amazon (e.g., U.S. customers buying from Amazon.co.uk)

Increased global trade and global sourcing elongates the supply chain and introduces longer moves. More importantly, global transportation adds new layers of complexity due to

- \* regulatory issues (export, import, and customs regulations)
- \* freight security and visibility issues
- \* working with non-domestic providers.

## **1.5. Impact of Change**

Change, especially unforeseen change, degrades a company's ability to optimize transportation networks. Change even affects monitoring and management oversight processes. Classic business analysis of initiatives calls for before-and-after analysis of performance metrics -- comparing the post-initiative performance to the baseline. But in the dynamic environment, the baseline may change. Changing load patterns, new distribution centers (DCs), and escalating fuel surcharges all disrupt the baseline scenario and corrupt comparisons of before and after costs.

## **2. Key Solution Elements**

### **2.1. Visibility**

The key to business performance is control, and the key to control is visibility. If a company can't see the event, it can't control the event. Shippers and carriers have different visibility requirements. Shippers want visibility into pending pick-ups and status reports that they can forward to their customers. On the inbound side, the customers want visibility onto in-coming shipments -- what's coming and when it will get there. Carriers want visibility onto forecast demand for transportation with information on the contents, origin, destination, and required pick-up and delivery times of loads.

For example, Transplace, a third-party logistics provider, worked with AutoZone, TruServ, and Office Depot to boost visibility onto inbound, cross-dock, and to-retail freight movements. In Office Depot's case, the added visibility supported troubleshooting. Office Depot now has a root cause analysis system that can pinpoint what prevented a line from being delivered on time.

In another example, carrier J.B. Hunt created real-time visibility onto sales commitments to avoid overselling capacity into any given market. In the past, the carrier's sales reps could easily sell more loads into an area than there were loads flowing out of that area on subsequent days. This resulted in stranded assets and more deadhead miles. Better visibility, inside the carrier, helps the sales force promise only what Hunt can profitably deliver

### *Measuring Visibility*

Amazon measures its transportation providers on the visibility they create. Packages that receive less than three scans (a scan at input, a way-point scan, and a delivery scan) are considered “invisible” to Amazon. Even if the package is delivered on schedule, Amazon gives unscanned shipments a lower performance rating on the fitness function evaluation of that package delivery service. Invisible, untracked shipments have a higher chance of causing high-cost free-replacement orders.

## **2.2. Collaboration**

As shippers insist on steadily better service at steadily lower costs, the need to collaborate increases. While shippers understand their freight, carriers understand their capacity and networks. Both P&G and AMR recommended intensive communications between shippers and carriers. By understanding each other’s businesses and needs, both sides can better structure their relationships.

Lack of coordination between shippers and carriers creates inefficiencies and ill will. Retailers think suppliers lie about backhaul costs, carriers think shippers lie about volume commitments, and shippers think carriers pad the invoice with off-manifest charges. Inappropriate constraints, outmoded policies, and misalignments on both sides lead to suboptimal transportation performance. Poor communications and inconsistent policies create misunderstandings and mistrust. P&G recommended operational ownership that creates a clean communications interface between the shipper and each carrier.

### *Performance Feedback*

Every month, the carriers for Welch’s get a report card that shows their own performance. Welch’s also lists the performances of the other carriers, withholding only the names of competitors. The rankings show performance for the most recent month and year-to-date cumulative totals. This helps each carrier see how they stack-up. Welch’s re-bids the business of under-performing carriers and re-bids all lanes every 3 years.

Other companies have similar feedback mechanisms. Amazon uses a 7-term fitness function to evaluate the performance of its transportation function and the carriers. The company updates these metrics in real time to give the company and its carriers timely visibility on the transportation function. Feedback also extends to the bid process. Manugistics noted that bid rank feedback between the first and second bid rounds helps the carriers understand their position.

Feedback also helps shippers regulate incumbent carriers. P&G, for example, prefers using incumbents but does not want to create a sense of entitlement. Monthly feedback ensures that carriers know where they stand.

### *Multi-link Collaboration*

Welch’s notes that in the retail supply chain, collaboration is beginning to span multiple links in the chain. While the ECR (Efficient Customer Response) initiatives of the 90s focused on

specific links between manufacturing, warehousing, and the customer DC, the new collaborative logistics efforts of recent years encompass the entire chain from supplier to the customer.

### **2.3. Flexibility for Carriers**

Carriers could offer better prices if the shippers offered more flexibility on pickup and drop-off terms. Flexibility would improve deployment of assets. Hunt recommended 48 hours of forewarning on tendering loads. Day-before arrangements are harder, and more expensive, because by 3 p.m. the day before, Hunt has 75% of its capacity already committed. With little remaining capacity, Hunt is less able to find a truck in the area, optimize the move, and minimize deadhead miles. Caplice and Harding described the use of real options to provide both the shippers and carriers increased flexibility in establishing their contracts. The two parties can trade-off their different risks in order to minimize the total expected cost of operations.

## **3. Trade-Offs**

Many of the discussions revolved around trade-offs in performance and costs.

### **3.1. Service vs. Cost**

The service vs. cost argument rages throughout all organizations. While the VP of Sales wants customer-winning service at all costs, managers with P&L responsibility fight for cost reductions.

#### *Rise of Service*

Many of the presenters and audience members noted the rising importance of service while acknowledging the need to control costs. After years of beating down transportation costs, shippers realize the value of service to their customers. Amazon highlighted the role of transportation service providers in Amazon's customer satisfaction -- the package courier is an important touchpoint with Amazon customers. With prepaid freight, the transportation company is representative of the supplier.

Carriers have also jumped on the service bandwagon. Hunt admitted that it had poor service levels during the 90s as a result of saying "yes" to too many contracts and loads. Now Hunt strives for better service using models that give them the discipline to say no to contracts which they cannot service profitably.

#### *Visibility Creates Importance*

With better visibility into more than just cost, shippers and carriers can create this new balance between costs and service. Because shippers can now measure and manage more than just cost, they are looking beyond just cost when procuring transportation. More companies place more weight on service than on cost. Welch's 4-term model emphasizes service in terms of "perfect orders." Likewise, Amazon's 7-term fitness function contains only two cost-related terms.



Although numerous companies continue to use reverse auctions to create cost competition, the bid price is but one factor in awarding the contract.

### *The Siren Call of Savings*

Even as P&G extolled the importance of principles and non-cost factors in awarding bids, it noted the seductiveness of chasing savings. When the quality-weighted bids don't save money, it's very tempting to "re-jigger" the formulae to choose cheaper carriers. P&G strongly recommended avoiding the temptation of cost cutting if those cuts violate the original principles and guidelines of the procurement auction. Not only would such rule changes lead to suboptimal carrier selection, but it could damage the shippers' reputation with carriers if the carriers realize that the shipper is really only pinching pennies.

### **3.2. Simplicity vs. Complexity**

Real patterns of demand for transportation are intractable complex. Both the shipper and the carrier have complex models for the cost and value of shipments. On the one hand, codifying these models into contracts helps create fair models of payment. On the other hand, these complex models can lead to compliance problems -- situations in which the shipper and carrier are unsure as to the contractually-agreed revenues and penalties.

### **3.3. Granularity**

When procuring transportation, shippers face trade-offs on the granularity of the data that they present to candidate shippers. Detailed data provides a clearer picture, but suffers from two general problems. First, the data can be intractable -- creating tens of thousands of line items on an RFP or optimization model. Second, fine-grained data lacks statistical validity.

Large companies, such as P&G, may have tens of thousands of unique origin-to-destination freight movements between plants, distribution centers (DCs), and retailers. Informing carriers of these details and soliciting bids poses a challenging trade-off regarding the granularity of the data. On the one end, P&G can spec their transportation needs in copious detail with 5-digit zip codes. Excessively fine-grained specification implies very little volume per lane and an intractable bid package. On the other hand, a coarse-grained definition leaves carriers wondering where their trucks will end up inside broad geographic zones. Two digit zip codes are often too big -- forcing carriers to submit worst-case over-bids based deadhead travel to span large zip zones.

For its most recent round of transportation procurement, P&G used a combination of 5 digit and 2 digit zip code definitions. This created 9000 lanes in the RFP. Feedback from the carriers suggests that this was still too complex. P&G may use 3 digit zip codes in the future or stay with a balance of 5 digit and 2 digit code definitions.

Similarly, providing lane-level data offers an accurate picture of the origin and destinations of shipments, but it also expands the number of bid items astronomically. Moreover, infrequently-used lanes are hard to bid. Some shippers aggregate the data to the facility level, giving carriers a better idea of the aggregate inbound and outbound volumes in each geographic region.

### **3.4. Number of Carriers: A Few Big Ones vs. Many Small Ones**

AMR found that many companies can reduce costs by strategic transportation sourcing and consolidating their carrier base. Many shippers have accumulated bloated rolls of carriers, accreting carriers over the years. Maintaining better, deeper relationships with a smaller number of carriers can help both parties. The key is to balance the forces that drive companies to choose more or fewer carriers. The rationale for using more transportation carriers includes:

- \* accessing added capacity and capabilities
- \* fostering competition
- \* reducing dependency on any one carrier

The rationale for using fewer transportation carriers includes:

- \* reducing the costs of managing so many carrier relationships
- \* leveraging of scale of each carrier
- \* developing stronger relationships/collaboration/expertise with the carrier through the volume of business

AMR discussed how companies use a strategic transportation sourcing initiative to right-size their carrier base. Shippers pick a set of core strategic carriers, fine-tuning the set, and reallocate volumes and lanes. AMR found that a Strategic Transportation Sourcing initiative provided an average savings of about 10%. Given the relatively modest costs of these sourcing initiatives, such initiatives often enjoy very high ROI.

P&G uses about 90 carriers to handle its \$700 million in outbound freight. This volume is heavily concentrated in a few large carriers: the top 10 carriers handle two-thirds of the freight, and the bottom 50 carriers handle only 5% of the freight.

Smaller shippers also maintain portfolios of multiple carriers. Welch's, a grape-growers' cooperative, has 14 carriers. Welch's prefers smaller carriers for the cultural fit. Monthly performance re-ranking and periodic re-bidding ensure that Welch's has the best carriers to meet its needs.

## **4. Developing Innovations**

### **4.1. Package Bidding**

In the past, shippers asked for lane-by-lane bids from carriers. The shipper would then choose the best (often the cheapest) carrier on each individual lane on an independent lane-by-lane basis. But the cost structures of carriers vary in the context of a pattern of lanes -- carriers can offer lower prices on one lane if they know they will also win the bid on another lane. In theory, shippers could enjoy better prices and carriers could gain efficiencies by packaging a collection of lanes

Auctions that allowed package bids, bundled bids, or combined value bids arose in the 90s. Technology supported this new style of auction. Software aided the thorny problem of crafting a

package bid and awarding lanes based on complex, overlapping patterns of package bids. To date, over one hundred companies have run optimization-based auctions.

MIT analyzed a number of these auctions using data from five vendors to understand the actual use of package bidding in industry. The researchers found that package bids were not as widely adopted as expected:

- \* only 28% of carriers submitted package bids
- \* only 40% of that 28% submitted more than 5 package bids
- \* only 16% of package bids beat the sum of the lowest individual bids
- \* only 58% of package bids that won were tendered

Some of the low rate of adoption of package bidding stems from the complexity of the process. As a new process, both shippers and carriers need to learn how to best leverage the concept. Shippers also need to change their transportation management systems (TMS) to reflect the complex pricing structures in rating engines and routing guides.

Another reason that packages don't see wider use is that they are fragile. The bid for a complex, multilane package can often be beat by the sum of the lowest low bids on the component routes. Some auction processes also inhibit the use of package bids by forcing carriers to bid on each component lane, something carriers may eschew because they only want the packaged volumes of business.

In many cases, package bids are not robust enough for use in a dynamic environment. Often, the package only makes sense within the context of other load patterns created by other shippers. But if the other shipper changes their pattern, then the package loses its advantage. Even closed loops face this problem if the carriers suspect that the inbound and outbound volumes may differ from the balanced values seen in the RFP. When carriers submit a package bid knowing that the award is still months away and that the contract terms may be binding for years, they face a high chance of a change in the network. This risk of change forces the carrier to submit a package bid that reflects the chance that future events may obviate the efficiencies created by the package bid.

## **4.2. Continuous Moves**

For capital-intensive industries, asset utilization drives return on investment. In transportation, this implies keeping trucks full with paying freight and on the move to their destinations. The concept of continuous moves is that a well coordinated transportation network could, in theory, keep the assets in motion through finely-choreographed moves. The recent Hours of Service rules create further incentives for continuous moves.

Yet companies found that implementing continuous moves is still too hard. Small glitches (a driver wanting to go home, a truck that needed maintenance, etc.) would break the chain. The continuous move concept seems too fragile. Even so, carriers using package bids cite continuous moves as the leading reason for submitting such bids. Welch's discussed its successful use of a 3-leg move involving coordination between Welch's and Giant Eagle.

## 5. Challenges

### 5.1. Planning vs. Execution

Significant advances in logistics theory and commercial software for logistics mean new opportunities for optimization. Using mix-integer programming, shippers and carriers now optimize the allocation of assets to activities, minimize costs, and design efficient networks. Companies like Sears, Wal-Mart, and P&G brought these ideas out of the lab into daily practice. These tools help shippers and carriers optimize complex networks, convoluted flows, and the complex allocation of assets to routes. Such optimization is a core feature of modern supply chain software.

Nonetheless, the presenters noted a serious gap between these optimized plans and the realities of execution. The vagaries of demand spikes, freight delays, and operational issues limit companies' abilities to execute the optimized plan. Heterogeneity in the IT maturities of companies also affects execution. Some companies don't understand how to properly set up the optimization model, interpret its results, or implement that plan. One presenter noted that their best-performing carrier is a small company that does not even own a computer.

#### *Low Rate of Tool Adoption*

Adoption of planning and procurement tools is far below 100% at shippers, too -- the BASS (an acronym for a very large spreadsheet) is alive and well. Hunt estimates that 85% of the RFPs it receives (and 52% of the dollar value) comes from shippers who don't use any commercial tool. Top IT packages such as Manhattan Associates, Manugistics, and CombineNet only account for 9% of RFPs or 36% of Hunt's bid volume.

#### *Savings that Don't Stick*

The gap between planning and execution means that planned savings fail to materialize. Even if the shipper receives generous savings on bids on a newly optimized network, those savings often don't stick. Bidder remorse and changing cost structures force carriers to turn down tendered loads or renegotiate rates or levy off-manifest charges. Maverick buying inside the shipper's organization leads to paying higher rates or paying penalties for not meeting volume guarantees.

#### *Turn-Downs Add Costs*

One side-effect of the planning vs. execution gap is turn-downs. Mat Harding, Manhattan Associates, reported the results of a study on turn-downs. The study found that approximately one in four loads is turned down by the primary carrier. On average, turn-downs lead to a 2% increase in overall freight costs. Turn-downs also cause additional labor costs (for securing secondary carriers) and create delays in shipment (as the company seeks secondary carriers).

### 5.2. From Any Data to Good Data to Meaningful Data

In the past, both shippers and carriers wished for data, any data. The companies wanted data on shipments, moves, lanes, costs, and so on. IT and widespread use of EDI and Internet

communications granted that wish for many companies. P&G mused how the company has evolved from diskettes to CDs to online spaces for sharing increasing amounts of data with carriers. But now companies find that these data are not as clean and comparable as needed.

### *Data Cleanliness*

Several presenters discussed the challenges of cleaning shippers' data. Data cleaning means looking for inconsistent data, misformatted data, and data that is not representative of future transportation needs. Part of the data cleanliness problem is caused by the disparate range of transportation modes and conditions -- the incomparability of rates for expedited short-haul refrigerated move versus an intermodal dry move. Off-manifest charges also complicate issues, making it hard for shippers to easily compare the true costs of alternative carriers. Companies such as P&G and Amazon carefully negotiate or eliminate these charges.

Good data is a prerequisite for successful transportation procurement. P&G spends time up front getting the data cleaned so that it can send out an accurate RFP. Even so, mistakes can happen.

### *Data Normalization*

Moreover, every company has its own format and fields for data. In many cases, companies have multiple internal formats created by different IT systems in different departments. When every company uses its own definitions and data architectures, creating normalized, comparable data is hard. But normalization is a key element of sharing data between shippers and carriers.

Amazon shared its approach to normalizing all shipping-related data to a common standard. This included creating a small number of alternative interfaces and negotiating common definitions with carriers, small package delivery services, and international postal authorities. For example, "expedited" shipping with Royal Mail means air freight, while Deutsche Post does not use air for what it calls "expedited." Standardizing the definitions of service levels helps Amazon provide a uniform level of customer service.

Creating the data architecture involves more than just a declaration by fiat by the dominant player. Although Amazon did insist that transportation suppliers interface with Amazon on Amazon's terms, Amazon also holds annual meetings with their suppliers. If a supplier can document why they need a particular special item of data, then Amazon will add that to the system.

Part of the data cleanliness problem is data semantics: what does a given code or annotation mean? For example, one company was using the code "LPBFD" in the delivery status field. Even a group of 40 transportation professionals could not decipher the meaning of LPBFD (Left Package By Front Door). In order to improve consumer satisfaction, Amazon is normalizing these codes and translating them into clear, easy-to-understand language.

Issues like time zones present a problem for real-time data such as tracking and status date. In Amazon's forthcoming global tracking application, all status messages will include times printed in both the customer's destination timezone and the shipper's package-local timezone.

### **5.3. Forecast Inaccuracy: The Curse of Uncertainty**

Forecast accuracy remains a sore point with carriers and a significant problem for shippers. Carriers make bidding decisions and asset allocations based on the shipper's forecasts for loads and lanes. When that volume fails to materialize, the carrier feels shortchanged. And if the volume exceeds expectations, the shipper may have trouble arranging timely shipment or may be forced to pay exorbitant rates on the spot market to gain additional capacity. Amazon takes forecast accuracy (or inaccuracy) very seriously. Prediction accuracy is one of the seven terms in its fitness function.

Transportation forecast quality varies across industries. Car makers, with their tightly-tuned production plans, have good forecast accuracy for their transportation needs. Retailers, on the other hand, have the hardest time with forecasting because they are subject to the fickle whims of consumers. Frito Lay joked that it wished it could design the consumer to create more constant, stable demand patterns. If anything, this problem will only grow. Amazon described rising consumer desire for instant gratification and narrow delivery windows.

### **5.4. Compliance**

As the complexity of transportation contracts grows, the problem of compliance increases. Sophisticated package bids, volume guarantees, SLAs (Service Level Agreements), fuel surcharge formulae, and accessorial charges increase the complexity of invoices. Compliance issues lead to disputes when the shipper and carrier disagree on the meanings of the contract terms or the particulars of a given fee, chargeback, or penalty. Compliance problems reduce the stickiness of savings, create added labor in resolving disputes, and generate ill will.

Amazon watches off-manifest charges carefully in two ways. First, it insists on explanations for billing codes from carriers. Sometimes even the carrier does not know the reasons of a charge, and so Amazon asks to have the charge removed. Second, Amazon tracks these charges for scoring the fitness of its carriers. Amazon wants cost visibility so that it can make appropriate carrier selection decisions.

### **5.5. Drivers Wanted**

For the trucking industry, driver shortages continue to plague carriers. Pricing pressures prevent the wage increases that carriers would need to provide in order to attract and retain drivers. Carriers look to other tactics to improve driver retention. For example, carriers now buy trucks to please the driver, not the shipper. Those rolling palaces help driver retention even as they create problems for shippers who want to maximize the weight of each load.

### **5.6. Five-Days-a-Week Operations**

Hunt noted that its assets sit idle two out of seven days because most companies run distribution on a Monday-to-Friday basis. Although drivers do get time off each week, the times may be staggered. Thus, carriers could increase capacity and asset utilization if shippers operated on Saturday and Sunday. This improvement would only work if a sufficient number of shippers adopted it. Hunt estimates that about 50% would need to adopt the policy to gain the most benefits.

Some shippers already use seven day-a-week operations and gain price advantages from it. Amazon, for example, uses its SuperSaver shipments (shipments to customers who opted for free shipping and more flexible transit times) to help level the loads that it injects into UPS' system. It often sends these shipments out on Saturday and Sunday, a traditionally slow time for UPS. Amazon gets a price break for helping UPS match loads to capacity, UPS gets better asset utilization and smoother demand, and the customer gets free shipping.

## 6. Future

### 6.1. Uncertainty Management: the Flaw of Averages

The notion of optimization presumes some known future state. Knowledge of that future state provides the basis for planning, network design, sourcing, asset allocation, and asset purchase decisions. Yet the future is very uncertain because of spikes and slumps in demand, ever-changing networks, and errors in forecast trends.

The next frontier for logistics optimization is the management of uncertainty. Both shippers and carriers need techniques to cope with the impossibility of forecasting transportation demand on the same timescale as transportation procurement. Both parties face potential problems when demand is different from the forecast that was used to bid and award transportation. Companies would like to negotiate contracts that last for quarters or years, even though they often have little visibility into the following week's pattern of freight movements. Worse, carriers must make investment decisions based on hazy assurances of future business about assets that have lifespans in the years or decades.

At some level, no one can make the problem disappear. For example, a \$5 billion food maker had recently conducted an optimization-based auction but found that traffic volumes increased dramatically shortly thereafter. Average lane volume grew 100% week to week in several remote markets. The small regional carriers that had won the majority of the contracts did not have the necessary capacity to meet the surging demand. Because the shipper had not valued flexibility in its optimized assignment, the carriers were selected regardless of this capability. The shipper was forced to turn to national carriers whom it had rejected in a recent round of procurement and pay much higher rates. Dr. Caplice suggested that companies need to either invest in robustness or flexibility to cope with the fundamental uncertainty of the future.

#### *Flexibility*

One solution to the problem is flexibility, such as real options. Real options are a tangible analog to financial options that let investors lock-in a buy or sell price on company stock on Wall Street. Real options borrow the extensive and well-understood mathematical framework that underpins financial options to assign appropriate values to options involving tangible goods and services. For example a real option in transportation might help a shipper lock-in capacity, giving the shipper the right -- but not the obligation -- to use a stated level of capacity from a carrier who sold them that option.

An example of real options for transportation might be flexible contracts. Current research at MIT is examining the use of real options in transportation contracts.

### *Robustness*

Matt Harding described how robustness provided another solution to uncertainty, creating a bullet-proof routing guide. Simulations of the statistical variations of freight movements, turn-downs, and delays would help a company optimize its plans for uncertainty. A robust solution has the advantage of not requiring real-time monitoring and sophisticated flex-responses. Robustness is the subject of ongoing research at MIT.

### *Costs Versus Risks*

Whether a company will adopt these techniques depends on the company's culture and outlook on risks and costs. For example, shippers currently bear the risk of rapidly rising fuel prices -- carrier's fuel surcharges mean that carriers recover changes in fuel costs from shippers. But how can shippers cover these risks other than by changing product prices to track fuel costs? Using the commodities markets, shippers could hedge their exposure to fuel prices in the same way that many airlines do. Some shippers in the audience, however, noted that they did not want to do this because of the very certain cost of shifting risks. For cultural reasons, adding a small known cost is more abhorrent than facing a high potential risk of escalating fuel prices.

## **6.2. Inflexible Service Demands**

Amazon noted that its customers have increasingly strict demands. Service demands mean more than just faster delivery. Although speed is good, many shippers and their customers are seeking time-definite deliveries. They want the product not only as soon as possible, but also exactly when they specify. Customers want specific delivery windows -- choosing both the time of day and the date -- in order to coordinate the deliveries with their busy schedules.

Amazon penalizes early deliveries just as it penalizes late deliveries. DCs operate on similar rules, too. Pick-up and drop-off windows define when each load should come in or go out to better match trucks, trailers, docks, and DC personnel. In retailing, the combination of unpredictable demand and limited in-store inventory space means an increasing need for frequent, time-definite deliveries.

## **6.3. Large-Scale Solutions**

Both Frito Lay and the U.S. Government's Volpe Transportation Center wondered about mechanisms for broader, industry-wide solutions to transportation network design, planning, and operations. The current piece-meal optimization process seems broken. Asynchronous bid-and-award cycles keep every carrier's network in a state of inefficient flux. The ongoing challenge of matching yellow trailers to yellow trucks also creates constraints on freight handling.

Industry-wide collaboration could help coordinate transportation activities and avoid both resource contention (when two shippers vie for the same capacity on the same day) and underutilized resources, transient imbalances, and deadhead miles. Welch's noted that Quaker



and Ahold (the grocery chain) created joint industry conferences to help coordinate transportation issues. Yet such consortia face a daunting legal challenge because they can run afoul of anti-trust laws. In the Quaker/Ahold meetings, the companies were very careful, to talk only about processes, to avoid the appearance of colluding on the numbers.

#### **6.4. Technology and Innovation Lifecycle**

AMR described the evolving space of technology vendors and logistics consultancies. New ideas evolve from thought leaders to consultancies and one-off implementations at forward-thinking companies. From there, technology companies start converting the more successful ideas into software. Along the way, specialized consultants and niche technology vendors rise to provide specialized functionality. Ultimately, vendors steadily induct more functionality into mainstream software offerings. Service providers offer outsourced functionality to companies that don't wish to manage tasks themselves. Increasing software maturity and the rise of low-cost web-based interfaces mean that technology will increasingly penetrate smaller carriers and shippers, according to i2 Technologies.

Universities, such as MIT, play a role in the development of new ideas. While industry may lead in practice, academics often lead in theory. The revolving door between industry and students getting advanced degrees such as MIT'S MLOG program help cross-fertilize the two camps. Consortia research programs, such as the one the hosted this conference, serve as a nexus for sharing knowledge between industry, academia, and government.

One example of the university-industry partnership is the massive 11 million square meter Zaragoza Logistics Park. Located in the neck of the Iberian Peninsula, it is a centrally located hub for distribution between southwestern and northern Europe. But more than just a hub, the park serves as a living laboratory for new innovative logistics practices. A new university sits at the center of the park and hosts the MIT-Zaragoza International Logistics Program. This program will produce a steady stream of trained logistics professionals and harvest the logistics knowledge generated at the sprawling Zaragoza greenfield site.

#### **6.5. Transportation Lifecycle**

Many of the presenters described elements of the transportation procurement lifecycle -- the ongoing process of specifying transportation needs, soliciting bids, awarding business, and managing a changing portfolio of carriers.

##### *Pre-Event Relationship Management*

P&G stressed pre-event relationships and processes as laying the groundwork for successful transportation procurement. The challenge for both shippers and carriers to create a process that is both collaborative and competitive. Clean data and good feedback from carriers helps the shipper craft an accurate RFP and set reasonable policies that will elicit win-win bids from carriers. The process also calls for internal understanding and alignment. For example, P&G wants to ensure that its supplier portfolio mirrors that of its customer portfolio in terms of representation by minorities. Thus, P&G has percentage allocations to minority carriers.

### *Bid and Award Process*

Well-defined, well-communicated RFP processes segue into well-run bid-and-award process. Manhattan associates recommended a sealed first round with a second round for selected prequalified candidate carriers. Both Manhattan Associates and P&G suggested using face-to-face meetings with carriers during the later round(s) of the bidding processes. Such meetings help convince the carrier of the shipper's sincerity.

As a 3PL, Schneider Logistics stressed the connection between the design of transportation auctions and the quality of the results. Open bids, sealed bids, reverse auctions, and package bidding all impact the behavior of carriers. Sometimes shippers are their own worst enemy: adding constraints to the process or violating their own goals during the awards process. Manugistics recommended using no more than two rounds of bidding because it makes carriers feel unfavorable pricing pressure.

Analyzing the results of a complex procurement takes time, but new tools help. Many companies run hundreds of scenarios to analyze all the trade-offs of accepting various combinations of carriers and their bids. CombineNet noted that one especially analytical customer collected and analyzed some 168 pieces of information about each bid. New tools offer much faster scenario analysis times, doing in minutes what previously took hours or days.

### *Transition Phase*

P&G highlighted the importance of transition planning: ensuring carriers have the assets needed to accept new or changing volumes of freight. For example, P&G noted massive turn-over, upwards of 80% of lanes changing hands, when the company goes through its semiannual transportation procurement process. This is in spite of an explicit preference for incumbents. Yet the turnover is mostly at the lane level -- P&G usually retains the same core set of carriers and volume levels, but changes who serves which lane.

Hunt gave the carrier's perspective on the transition phase of the transportation lifecycle. Hunt referred to this as the Red Carpet program -- working intensively with the shipper to understand the details of the new business.

### *Execution, Monitoring and Feedback*

The workaday process of transportation involves the tendering and acceptance of loads and the work of getting the right goods from the right place to the right destination at the right time. Both shippers and carrier use monitoring to analyze the performance of contracts. This phase includes a timely cycle of monitoring and feedback that helps the parties maintain their relationship. Compliance efforts ensure that both sides stick to their part of the bargain -- that the shipper sees the expected savings and the carrier sees the expected business volumes.

## Detailed Presentation Summaries

This section presents detailed summaries of each of the seven presentations made during the symposium.

### 1. Latest Innovations in Transportation Procurement Panel (Mitchell, Concordia, Martin, Kohne, Menner, and Gabel)

This session consisted of a panel of experts moderated by Pierre Mitchell, AMR. The panel consisted of: Mike Concordia, CombineNet; Josh Martin, i2 Technologies; Chris Kohne, Manugistics; Matt Menner, Manhattan Associates; and Doug Gabel, Schneider Logistics.

Pierre led off the panel discussion by noting that AMR Research's 2003 Strategic Transportation Sourcing revealed that the biggest procurement problem companies face is poor visibility and data integration. Companies need to integrate bidding optimization, transportation planning and direct material sourcing back into network design -- a task that will require new analytic processes, decision making, and tools.

Pierre then highlighted the opportunities for strategic transportation sourcing (STS), likening the process to direct materials strategic sourcing with some added difficulties due to the complexity of carrier networks. AMR's study found that 90% of the companies that undertake an STS event are satisfied and save an average of 10% on transportation costs.

The five panelists, comprising vendors whose software is used by approximately 85% of the companies surveyed in AMR's study, were then asked to answer three questions:

What is the biggest benefit of using transportation procurement software?

What are the biggest challenges to using this software?

What is the next big thing to hit transportation procurement?

Each is discussed in turn.

#### What are the Biggest Benefits of Optimization Based Bidding Technology?

- \* Doug Gabel, Schneider Logistics, noted that they measure the benefits the software provides by examining the long-term sustainable results for its customers. Specifically, Schneider Logistics looks at whether the customer achieved the actual savings projected from the auction. Doug reported that Schneider Logistics' customers see a 90% compliance rate in their combinatorial auction events, compared to the commonly-seen 40-60% compliance in other bid processes. He attributes this success to better auction design. Because Schneider Logistics works with over 1000 carriers, it knows the strengths of each carrier and can match lanes and bids to carriers whose network supports those lanes.
- \* Chris Kohne, Manugistics, stated that the major benefit of this type of software is the ease of use of its web-based format. Customers can put in performance ratings, can model lane

matches to see if they have bad matches, and can tie weak lanes to strong lanes to make their business more attractive to carriers.

- \* Josh Martin noted that i2 Technologies software lets companies increase or decrease the complexity of their networks to meet their needs. The software can execute a complex network, enabling shippers to increase the complexity of their bid packages. Or, shippers can decrease the complexity by creating a core carrier group and focusing on collaboration with that group. For carriers, i2 provides data to analyze and do projections and costing.
- \* Mike Concordia explained that CombineNet offers customers three ways to achieve the lowest costs for their networks. First, CombineNet offers flexibility in bidding. Companies often handcuff carriers with restrictive bid packages that reduce the ability of the carrier to submit good bids. CombineNet software offers an "expressive bidding" feature that lets suppliers bid in their own terms, based on their best terms for service, price and discounts on specific lanes. The software takes competing bids and factors them into the client's sourcing optimization model. Second, CombineNet lets carriers make if-then offers, such as offering discounts based on the volume of a lane or combination of lanes. Third, shippers can create their own scenarios. CombineNet's fast solver lets shippers run hundreds of scenarios to test the cost of different business rules. Generating multiple scenarios quickly has helped shippers reduce their sourcing time dramatically from nine months to nine weeks for one shipper, for example.
- \* Matthew Menner of Manhattan Associates commented that the technology helps shippers with complex networks analyze scenarios to determine savings based on different options. He noted that it is best to offer a technology core with a services wrapper. The technology links optimized procurement, integrated planning, and advanced carrier management capabilities to provide a supply chain execution solution.

### **What are the Biggest Challenges to Optimization Based Bidding Technology?**

- \* Schneider Logistics noted that the biggest challenge is dealing with paradigms of the past. When companies conduct auctions, the bids they receive are directly the result of the auction style they use. Carriers bid differently in the various auctions dependent on the auction design (reverse auction, combined value auction™). Thus, the auction design will drive carrier-bidding behavior. "Analysis and simulation is only as good as the data you get and the auction style you use," Doug Gabel said.
- \* Manugistics said that one of the biggest challenges is helping clients create packages that are not unduly complex. The packages must be implementable, so Manugistics works with clients to make sure that the winning carriers will be able to actually execute the bids and actually deliver on its promises.
- \* i2 Technologies saw data integrity as a challenge: shippers must make sense of their mass of data before giving it to carriers. The first step is to identify lanes, zones, etc. and dive into the details of the data that will be passed to carriers. Second, data from carriers must also be analyzed. i2 goes through a validation step prior to optimization.
- \* CombineNet agreed that data cleanliness is a difficult challenge. Shippers overestimate how clean their data is, and on complex projects involving 90,000 lanes and 300,000 bids,

data quality is important. CombineNet, like most of the other vendors, can provide a support team to assist the shipper with the data to make sure it is in shape.

- \* Manhattan Associates mentioned that one key challenge is working with shippers who haven't gone through the process before. Menner explained how their project managers manage the entire process – from data collection, cleansing, and forecasting to the development of the network, and the running of multiple scenarios.

### **What is the Next Big Thing in Transportation Procurement?**

- \* Schneider Logistics sees new combined value auction™ bidding process in pan-European markets as the next big thing. Carrier economics in Europe is different than in the US. Combinatorial bidding has a big role in Europe, but its nature is different.
- \* Manugistics said the next big thing is international logistics network design. The company is working on closed-loop tools to help clients better forecast their equipment needs and use that forecast information to optimize the way their networks work. The tools help companies make use of private fleets and set up common loops.
- \* i2 Technologies suggested that tools with higher reliability and more insightful pricing models would be important for carriers. These tools would allow small carriers to conduct in-depth costing analysis and actually quantify what goes into the pricing. The second "next big thing" is integration with other transportation products on the planning side, pooling data to get an overall view.
- \* CombineNet said that dealing with increasing complexity is the next big thing, such as a global aggregated bid for third-party logistics providers. The kind of task (in one case funded by NIST) is to solve the marketplace problem in which a group of shippers sourced together as a group.
- \* Manhattan Associates noted that global expansion and the transportation lifecycle will be the next big thing. Compliance to bids is just the first piece of the lifecycle.

## **2. Next Generation Transportation Procurement (Caplice and Harding)**

The second presentation was made jointly by Matthew Harding of Manhattan Associates and Chris Caplice of MIT.

### **The Problem: Savings that Don't Materialize**

As more companies use sophisticated optimization packages, they find that the savings sometimes don't materialize or stick for very long. Dr. Caplice described the history of companies using mixed integer programming technologies (which all of the vendors on the previous panel discussion rely) to solve some very tough problems in transportation optimization. Package, bundled, or combined value bids let carriers submit lower price bids for efficient combinations of the lanes. By creating out-and-back loops, aggregating traffic to facilities, or meshing the loads in the bid package with other loads handled by the carrier, carriers can reduce empty-miles and leverage both their economies of scope and scale.

Dr. Caplice noted that over one hundred companies have now used package bidding. Yet research on actual auctions uncovered a low rate of the use of package bids. Only 28% of carriers in Combinatorial Auctions actually submit package bids. Of those that do, they tend to submit very few of them (60% of carriers submit only 5 packages or less) and they tend to be quite small (50% are only 2 lanes). Finally, only 58% of winning package bids are even tendered actual loads when they 'win' in the auction.

The under-utilization of package bidding stems from several reasons. First, package bids are fragile: only 16% of package bids beat the sum of the lowest bid. Second, uncertainty in the volume of actual business makes these bids hard to craft and price. Dr. Caplice cited the example of a food manufacturer that had used optimization based bidding to secure carriers. They selected the lowest cost solution which was comprised of a number of smaller, regional carriers. When there were unexpected surges in excess of 50% per week, the primary carriers could not provide the additional capacity so the company was forced to pay high rates to the very carriers whom the company had recently rejected in an optimized auction! The incumbent carriers had essentially "lost the bid but won the business".

### **Why this Matters**

Matt Harding argued that transportation plays a growing role in the coordination of supply chains. More than just a matter of contracts and carriers, transportation has become the hub that connects suppliers, customers, distribution, and the flow of orders. The growing use of information and increasing service level requirements are driving the need for better procurement processes.

Increasingly tight capacity in trucking also motivates improved procurement and management processes. In a 2004 survey by Bear, Stearns & Co., 50% of the shippers surveyed thought the truckload (TL) market was either "tight" or "extremely tight" in the third quarter of 2003, double the number from the year before. At the same time, the majority of larger TL carriers are not expanding while the number of smaller carriers going bankrupt is increasing.

Turndowns will increase as transportation demand outstrips capacity unless shippers and carriers craft innovative solutions. Mr. Harding's study of turndowns found that they can affect nearly 28% of all loads from a facility. Each turndown led to delays (averaging 2 days) and 9% higher costs for finding secondary carriers. Overall, turndowns can add 2% to total freight costs.

### **Potential Solutions: Flexibility & Robustness**

Dr. Caplice discussed two strategies for handling uncertainty transportation management: Flexibility and Robustness. Flexibility is a strategy whereby shippers and carriers craft contracts that allow for certain courses of action to be taken based upon the current situation. These real options, based on the same concept as financial options, provide the shipper the right, but not the obligation, to use capacity, to change sourcing, to abandon contracted assets, and so on for a pre-arranged price.

For example, Dr. Caplice suggested that flexible transportation contracts might be written to allow shippers and carriers to trade-off their different risks. A carrier would commit to a specified surge capacity at a contracted rate in return for securing a guaranteed commitment of

loads from the shipper. The advantage of an option like this, is that both parties are protected from the risks that they are most sensitive to. Current research on-going at MIT is looking to quantify and calibrate the specific structure of these contracts.

Second, robustness as a strategy could create passive protection. Simulation tools can help shippers and carriers understand the variability of transportation supply and demand. By integrating simulation within the general optimization framework, the shipper could determine the routing guide that is able to sustain the most variability at the lowest total cost. This robust routing guide would improve performance without impacting daily operations. Research into both robust planning and flexible contracting at MIT is currently underway is expected to continue for the next several years. In fact, Matt Harding is starting at MIT in the fall to continue his research into these topics.

### **3. Managing Carrier Relationships after a Transportation Procurement Event (Kent)**

Rick Kent, P&G, made the next presentation which focused on how shippers should manage its post-bid carrier relationships. Rick noted that the post-event relationship with carriers begins before the bidding event and is an ongoing process. Procter & Gamble conducts sourcing events semiannually and has done four events since 1997. The company debates internally whether this is the optimal interval between events. Conditions change more frequently but doing a bid event takes time, so the interval between bid events needs to balance cost and value to the company.

#### **Goals of the Procurement Event**

The goals which P&G wants from its transportation procurement event are, first and foremost, to increase capacity. Second, the company wants to improve on-time reliability. Reducing costs ranks third in importance.

#### **Value of Incumbency**

P&G values incumbents in its procurement events and protects them, although it estimates that this protection costs the company about 20-30%. The reasons why P&G values incumbency are that it provides stability of network flows and leverages the knowledge and expertise of the carriers. At the same time, P&G recognizes that rewarding incumbency could stifle innovation or new capability. Therefore, P&G asks its incumbents to provide solutions that speed up transit time. Speed helps the end customer and lets P&G be more responsive to that customer. Finally, P&G looks for supplier diversity, with a goal of creating a supplier base that matches the diversity of its customer base.

#### **Pre-Event Relationship Management**

P&G uses a set of principles to guide its transportation procurement decisions. Before it begins a procurement event, P&G solicits feedback from carriers about what worked well or didn't work well in the last procurement event. For example, in 2001 P&G ran a reverse auction. The reverse auction garnered cost reductions but severely stressed carrier relationships. Carriers felt

that P&G had shifted to a cost-only buyer. P&G had chosen this type of auction because it was facing strong Wall Street pressure, but in its 2003 procurement event, P&G decided not to use the reverse action format.

Before a procurement event, P&G also establishes the success criteria that it will use to make the award determinations. It is important to get internal alignment on these criteria. For example, P&G's sales organization looks for on-time reliability and fast transit speed, while business leaders look for cost reductions. It's important to set the criteria and then adhere to them.

P&G meets with its incumbent carriers before the procurement event in order to review their performance. This type of review lets carriers know how they are doing and, because it's done about 6 months prior to the event, it can serve as additional motivation for them to improve their on-time reliability and acceptance rates prior to the event. P&G also uses the pre-event meeting to tell carriers about new business that will be awarded, or a new technology or service that will be implemented, helping to build excitement about the event. Good carriers see the bid events as a growth opportunity.

During the bid event, P&G clearly defines the whole process to carriers, shares the timeline, and answers questions in an FAQ format so that all carriers can see all the questions and answers.

### **Post-Event Relationship Management**

To manage post-event activities and relationships, P&G sets a transition plan. Part of the plan involves asking carriers to submit their own transition plans. For example, if a carrier doing 20 loads for P&G will now be doing 100 loads, the carrier needs to have a business plan to show how they will be able to provide that additional capacity. The plans are simple in format -- 1-2 pages -- but P&G holds suppliers accountable to the transition plan they make.

P&G expects carriers that win the bid to accept the business and, in the interest of moving forward and minimizing disruption, P&G does not give carriers a lot of time to decide whether they will accept or reject the business. The pre-event work with carriers minimizes rejections.

After the procurement event, P&G holds monthly performance reviews with carriers, with the performance measures shared beforehand.

If a carrier makes a request that breaches the original contract, P&G goes back to the original principles of the procurement. It tells the carrier that the sourcing principles were clear and the contract terms are firm. Although capacity is tight and carriers may say they need to charge more, P&G shows the flipside that during other times P&G honors its commitments and makes sacrifices, so it works both ways. P&G wants to maintain the integrity of the bid and not let carriers change rates later, although the company will work with carriers in principle-based ethical ways to handle unforeseen circumstances.

## **4. Managing the Inbound Network (Sanderson and Biggs)**

The fourth presentation was made jointly by Tom Sanderson, Transplace, and Dee Biggs, Welch's. Mr. Sanderson discussed inbound logistics for retailers, namely how to ensure that a



network of stores has the right merchandise at the right time. This goal places high demands on retailers' logistics systems and drives them to consider the services of a third-party logistics provider. Transplace shared three customer case studies of AutoZone (auto parts), TruServ (hardware retailer), and Office Depot (office supplies) to illustrate specific points.

### **Goals for Retail Inbound**

The goals for retail inbound include improving service levels, reducing operational costs, and reducing capital costs. Getting complete orders to the right store at the right time would help avoid stock outs and could improve the retailer's top-line. Higher frequency shipments would let retailers decrease backroom inventory. At the same time, retailers and distributors need to hold the line on costs by seeking more efficient transportation strategies and minimizing staffing costs. The key to balancing these competing goals is supply chain software and better visibility.

### **Consolidating LTL**

Reducing LTL shipments, minimizing inventory, and holding down staffing costs rank high on retailer priorities. For example, AutoZone reduced its use of LTL from vendors by consolidating shipment to TL. Rather than ship LTL from every vendor to every DC, AutoZone consolidated the volume from each vendor, shipping to the nearest DC. Cross-dock flows then efficiently handled the internal flow of the merchandise.

### **Vendor Allowances**

And when a company redesigns its inbound network, it can often negotiate favorable allowances from suppliers. TruServ used allowances for LTL shipments to more than cover the costs of a new consolidated TL and crossdock scheme. Shifting from prepaid to collect freight has other benefits, too. When customers agree to collect the freight themselves, they can negotiate allowances off the price of the product from the supplier. AutoZone improved control over the timing of inbound freight when it shifted 77% of its suppliers from prepaid to collect freight.

### **Visibility**

Retailers also seek visibility on their inbound networks. Inventory in the pipeline can be an extension of DC and in-store inventory only if the company knows where the shipments are and what's coming when. AutoZone reduced total inventory through improved Advanced Shipping Notices (ASNs) and on-line visibility tools. Similarly, Office Depot used improved visibility for troubleshooting; it conducted root cause analysis on who prevented on-time delivery of lines on orders. Finally, TruServ used improved visibility to identify inefficient processes.

### **Welch's and the Evolving Retail Supply Chain**

Mr. Biggs discussed Welch's perspective on the retail supply chain. Supply chain management is a large part of the service that Welch's provides to its 1351 grape-growing members. The grower cooperative handles a wide range of supply chain services for its members -- from purchasing and inbound transportation, to inventory and manufacturing, to outbound transportation and logistics services for retailers that carry Welch's products.

## **Key Metrics at Welch's**

Welch's supply chain strategy focuses on the basics by simplifying processes and emphasizing quality of execution. Welch's has a culture of service that focuses on the four conditions of a perfect order: orders that are complete, on-time, undamaged, and have an accurate invoice. Value-added services also differentiate Welch's supply chain. Services such as VMI (Vendor Managed Inventory), CPFR (Collaborative planning, forecasting, and replenishment), supply chain visibility, and new technologies such as collaborative transportation software and RFID (Radio Frequency Identification) tagging help the company provide service to retailers.

## **Transportation at Welch's**

Fourteen core carriers provide inbound and outbound transportation at Welch's. Welch's prefers smaller carriers because it found that larger carriers don't mesh as well culturally with the company. Welch's comprises 50% of the business for many of its carriers. One carrier is so small it doesn't even own a computer, yet it is one of Welch's best vendors. Despite its use of smaller carriers, Welch's benchmarks itself very well on transportation costs and service levels.

Welch's uses a monthly ranking scheme to provide open and timely feedback to carriers. They score carriers on five key measures of service: on-time delivery, cooperation/flexibility, percent order accepted, billing accuracy, and claims. The report card presents the monthly and year-to-date performance of the carrier and all the other carriers (excluding only competitor's names). Providing information to carriers lets carriers know exactly how Welch's rates them and how competitive they are. Welch's will re-bid the lanes covered by under-performing carriers, and it re-bids all lanes every three years.

## **Evolving Supply Chain Trends**

Over the company's 134-year history, it has seen many changes. For example, the retail supply chain has evolved from the inefficient 140-day supply chain prior to the 1990s, to the ECR (Efficient Customer Response) supply chains of the 90s, and toward the faster collaborative logistics supply chains of the 21st century. Collaborative planning, forecasting, and replenishment (CPFR) will help improve the efficient flow of goods.

As these trends have progressed, the focus of improvement has shifted outside of each company's four walls to encompass more and more of the upstream and downstream links of the supply chain. For example, Welch's is now experimenting with joint carrier procurement with its retail customers, which reduces transportation costs regardless of ownership. A pilot auction combines lanes from both Welch's and Giant Eagle (a grocery chain) to create efficient 3-legged routes for package bidding. The initiative garnered a 2.5% savings and Welch's plans to expand the program.

Welch's see the future as moving from the concept of a perfect order to that of a perfect shelf. Out-of-stock conditions remain an issue. Greater collaboration between shippers, carriers, and retailers would provide high-velocity inventory and greater service levels without excessive costs.

## **5. Linking Bidding & Operating Strategies: A Carrier's Perspective (Matthews)**

The fifth presentation was made by Terry Matthews from J.B. Hunt. Mr. Matthews provided the carrier side of the transportation procurement story. Hunt responds to some 600 bids per year. Only a minority of these are formal requests for proposals (RFPs) -- 15% of bids and 48% of dollar volume -- involve standardized commercial procurement software packages such as Manhattan Associates, Manugistics, or CombineNet.

### **Bidding Preferences**

On bids, Hunt prefers more rather than less detail on the shipper's freight network. Data on traffic seasonality (month of year and day-of-week) and specific point-to-point moves are critical for evaluating the appropriate price on the bid. Two- or three-digit zip codes are not enough because they don't provide enough location specificity. Hunt also prefers a two-round bid process comprised of a screening first round and a soft second round for finalizing details. Hunt also prefers online bidding, but it admits that it still receives faxed RFPs. Mr. Matthews also noted that the more constraints that the shipper adds to the RFP, the higher the price the carrier has to charge. Information and flexibility is the key to cost-efficient routing of the carrier's resources.

### **Transition Time**

Hunt described its Red Carpet process of working with new business after it receives the award. Hunt coordinates with the customer to understand the loads, facilities, hours of operation, and so on. The company then feeds relevant data into its asset allocation system to ensure that the needed trucks will be in place. Finally, Hunt monitors execution to ensure that the shipper tendered the promised level of business.

### **Visibility in Sales**

Technology and organizational discipline have improved Hunt's performance. In the past, Hunt accepted all new business and then faced the challenge of having trucks "shotgunned" all around the country. Now, the company is more selective in choosing to bid for and accept loads that fit the company's network.

As with shippers, visibility and operational discipline became a key part of improving the situation. In the past, Hunt would tell sales people about imbalances -- that they had 280 trucks inbound to Atlanta but only 80 outbound, for example. Although each sales person might only find a couple of outbound loads, the aggregated effect could easily oversell the outbound. This would swing Hunt to an imbalance of too many outbound trucks. Real-time visibility and control of the sales process ensures that Hunt only accepts the loads that it can profitably and successfully serve. The system also incorporates buffers to ensure that Hunt has capacity to meet last-minute commitments to established customers.

## **Tendering Loads**

The audience asked about lead-time on tendering loads: how early should the shipper alert Hunt to upcoming freight. Hunt recommended at least 48 hours warning. By 3 p.m. the day before, the carrier is already 75% committed. Early tendering gives Hunt the opportunity to better position its assets, reduce deadhead miles, maximize capacity, and provide better service.

## **Driver Shortages**

Mr. Matthews decried the perpetual shortage of drivers and its effects on Hunt's strategies in bidding and accepting business. For example, Hunt buys the types of trucks that drivers prefer rather than ones that are the most efficient or have the highest weight capacity. Hunt uses the trucks as a recruitment incentive to attract qualified drivers.

The driver shortage problem was exacerbated by the recently changed Hours of Service (HOS) rules that restrict the practical number of hours that drivers can drive. Hunt estimated that the rules would slow freight velocity by 8%. In response to HOS, Hunt reduced multi-stop loads by over 31%. Hunt also shifted toward appointment "windows" rather than firm appointment times to aid flexibility and reduce the number of hours that drivers spend waiting for loads. Shippers also changed their behavior, reducing both live load pickups and deliveries while accelerating the loading/unloading time. So far, Hunt has seen only a 4% reduction in velocity, half the expected performance penalty with the new HOS rules.

## **Future Opportunities**

Hunt suggested that 7-day-a-week operations would help the carrier smooth the loads across the week. Currently, most shippers, distribution centers (DCs), and receiving docks operate only 5 days a week for much of the year. Worse, freight demand is bunched to Thursday and Friday. Hunt knows that the industry is capable of 7-day-a-week operations because that is what happens in the fall. Operations on Saturday and a Sunday as well as intra-week smoothing would help carriers fully utilize their assets. Such a move would also reduce the chance of turndowns with primary carriers. If at least 50% of the shippers shifted to 7-day-a-week operations, carriers like Hunt could provide more effective capacity to counteract the current tight market conditions in transportation.

## **6. Managing the International B2C Channel: Customer Expectations Driving Transportation Network (Lakshman)**

Girish Lakshman, Amazon, presented next. He noted that while transportation is the second largest expense at Amazon it is managed by only 30 of the company's 7800 person staff. This is because so much of it is outsourced to dozens of carriers and package delivery firms. Ship2Deliver, Amazon's name for its outbound side, is a key element of the company's customer service strategy. Package delivery is one of only two touchpoints for most Amazon customers,

and it is the only one that involves a human being. For that reason, Amazon takes responsibility for ensuring the quality and consistency of the delivery service.

### **Collaborating with Carriers**

Amazon works with a wide array of carriers, from FedEx and UPS to PFI and SmartMail to Deutsche Post and Royal Mail. Shipping some 1 million packages a day at the peak of the holiday season, Amazon is a top 5 customer of both UPS and Fedex and the #1 customer of a range of other carriers like Airborne and SmartMail. In the U.S. alone, Amazon uses 26 carriers. Amazon chooses multiple carriers in most markets to provide access to capacity, promote competition, and avoid dependency on any single carrier. For example, Amazon has Deutsche Post delivering in Canada, UK and France, thereby creating competition for domestic monopoly postal services.

### **Standardizing the Definition of "Standard" Shipping**

Every carrier, especially those overseas, has its own definitions of service levels. For example, Royal Mail's definition of "expedited" means the use of air freight. In contrast, Deutsche Post's definition of "expedited" does not involve air. Amazon recently reached agreements with seven European postal services to standardize their transit times.

Standardization also applies to the status messages that carriers report back to Amazon when a customer asks for the status of a shipment. In the beginning, Amazon (and its customers) found the terminology opaque. Even a panel of transportation professionals did not know what some of them meant, such as "LPBFD" meaning "Left Package By Front Door." An Amazon-led carrier consortia is working on standardizing not just technology but also the services, labeling, status messages, and parcel regulations. Irrespective of the carrier, Amazon would like to provide a uniform customer experience on all fronts.

### **Normalization**

Amazon has created standard interfaces which it uses with carriers. Although each major package delivery service has its own system, Amazon has driven the adoption of Amazon's own standard across its carrier base. The interface covers four key functions: package tendering, package status, package tracing, and electronic invoicing.

### **Performance Measurement**

Amazon uses real-time data to feed a proprietary 7-term fitness function which it uses to both evaluate itself and evaluate its carriers. Only two of the seven terms involve cost. Amazon uses the data internally and shares it with its carriers in real-time. The company also shares its predictions for expected values of the fitness function during the year, thereby level-setting the expected performance of carriers.

### **Prediction**

Prediction plays such a major role at Amazon that prediction accuracy is one of the metrics in the fitness function. The company works to refine its ability to predict lane volumes, weight

breakdowns, dimensional requirements, customer-selected service options, and transit times. Amazon expects its carriers to provide accurate predictions of transit times, and it monitors carriers' prediction accuracy. Because many customers want date-definite delivery, Amazon penalizes both early and late delivery on its premium shipping services.

### **International Issues**

With distinct Amazon sites in Germany, the UK, France, Canada, Japan and the US shipping to anywhere in the world, Amazon had to learn about local preferences. For example, regions vary in terms of preferences for what to do when the recipient is not at home: whether to leave a notice or leave the package. U.S. customers tend to prefer the package, whereas Europeans prefer the notice. Regions also vary in terms of preferences regarding uniformed couriers. In some countries, a UPS driver looks like a police officer. Customers in some countries like receiving status updates via cellphone text messaging, whereas customers in other countries rarely use that service.

A further challenge for Amazon is that more customers are ordering from foreign Amazon sites - Americans ordering from the UK, Europeans ordering from the U.S., and so on. This necessitates creating global standards for shipping and ensuring full visibility. For example, Amazon's new status report presents the scan times for packages in both the customer's local time zone and the carrier's time zone.

### **Visibility**

Without timely scanning of a package, that package is invisible to Amazon. Any package that receives fewer than three scans is considered invisible to the company (packages receive as many as 21 scans). Such events negatively affect the carrier's fitness function level because invisible packages have a higher rate of customer service problems that result in Amazon shipping a free replacement. Amazon also uses the intensive scanning data to help predict in-transit times and to predict expected delivery dates. In some cases, Amazon knows more about transit cycle times within the carrier's network than the carrier does.

### **Future Opportunities**

Ultimately, Amazon seeks to shrink what it calls the availability gap -- the time it takes consumers to acquire a product from a local bricks-and-mortar retailer vs. the time taken to receive the product from Amazon. Most consumers can find most products within 20 miles of their home, yet the median shipping distance for Amazon is 450 miles, which means that it takes longer for delivery than for local purchase.

To increase the potential for instant gratification, Amazon is considering denser network designs, different sourcing arrangements, and even same-day couriers to provide more timely delivery for an increasingly demanding customer base. Already, internal improvements let customers order later at night and closer to Christmas and still make the deadline for shipping. For Amazon, transportation plays a vital role in compressing the need-to-possession cycle while providing the consistent, low-cost Ship2Deliver service that it has trained customers to expect.

## **7. New Ways of Adding Value in Transportation: UPS Trade Direct (Amling)**

The final presentation was made by Alan Amling, UPS. Mr. Amling noted the rise in global trade and the increasing volumes of international freight. The largest growth rates for airfreight are domestic China, intra-Asia, Asia-North America and Asia-Europe. Moreover, the rise of the web lets companies find global customers. Yet a survey of 1600 small- and medium-size businesses shows that 50% of international orders go unfulfilled because of international shipping issues. Accordingly, UPS wants to expand its offerings to support a wider array of logistical services to include distribution and reverse logistics.

### **From Supply Chains to Value Chains**

According to MIT Professor Gabriel Bitran, supply chains are evolving into value chains. They are becoming more dynamic, flexible, collaborative versions of the old supplier-to-customer hierarchical supply chains. For example, Hong-Kong-based TAL makes one out of every eight of the shirts sold in the U.S. This includes a demand-driven supply relationship with J.C. Penney in which shirt sales over the weekend in the U.S. drive manufacturing of replacement shirts in Hong Kong the following week.

### **New Services to Facilitate International Shipping**

Service providers (e.g. third party logistics providers), including UPS Trade Direct are developing and offering new services that are intended to aid international shipping. These services combine international freight and freight brokerage with small package delivery. Rather than send a large number of small packages, the service provider supports the consolidation of the shipment. Once the shipment reaches the U.S., it is broken down into smaller packages for shipment to U.S. destination.

There are several advantages of these services – as an example, they allow the shipper or retailer to skip the DC -- items come out of customs and go directly to their destination via the carrier's network. Eliminating the traditional DC reduces time, handling, and inventory costs. For retailers who want to delay deciding where to ship the goods, some carriers can label and ship the items after those items have reached the U.S. For shippers, these services provide a domestic point of presence for international companies, with a U.S. return address for packages, and often serve as a single point of contact, coordination, and troubleshooting for the complexities of international transportation.