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Please use the same title listed on the 75th MORSS Disclosure Form 712 A/B. If the title of the presentation has changed please list both.)

Original title on 712 A/B: Using Expressive Commerce™ to Support Army Reset Equipment Allocation and Distribution Decision Making

If the title was revised please list the original title above and the revised title here: Using Expressive Commerce™ to Support Defense Mobility and Transportation Planning

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Changing the Game
Using Expressive Commerce™ to Support Defense Mobility and Transportation Planning
Presented to Working Group 18 Mobility and Transport of Forces

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Charley Mitchell
charles.j.mitchell@us.pwc.com
Agenda

• Team and Technology
• Commercial Experience with CombineNet Technology
• Possible Military Uses for CombineNet Technology in Defense Transportation and Mobility Planning
• Summary and Conclusions

Working Group 18
• State-of-the-art technology
• End-to-end analysis of mobility and transportation requirements
• Support senior-level decision-makers with timely analyses
Team Overview

PricewaterhouseCoopers (PwC)

One of the largest integrated professional services firms in the United States serves the U.S. Federal Government through our Washington Federal Practice (WFP). PwC’s WFP dedicated team of multi-disciplined professionals offer deep technical expertise and innovative solutions to provide seamless services to our government clients.

CombineNet, Inc.

A technology company staffed with world class operations research and combinatorial scientists and seasoned industry executives. CombineNet’s Decision Guidance Tools are applied across government and commercial enterprises to assist decision makers in the fields of strategic sourcing, transportation and logistics, healthcare, energy, homeland security, and advanced optimization / planning applications.
PwC & CombineNet Team
Technical & Domain Expertise

PwC Technical Expertise
• Financial Management
• Supply Chain
• Strategic Sourcing
• Privatization & Outsourcing
• Performance-Based Management
• Lean 6 Sigma
• IT Security & Controls
• IT and Financial Effectiveness
• IT ERP Expertise (SAP, Oracle, etc.)
• Program Management
• Portfolio Management
• Global Best Practices Database

PwC Domain Expertise
• Colonel (Ret.) Charley Mitchell
• Colonel (Ret.) Dan Bartlett
• Colonel (Ret) Bob Speer
• Mike Schwed (Colonel, USAR)
• Battle Captains

CombineNet Technical Expertise
• Dr. Tuomas Sandholm (Founder, Chairman, and Chief Scientist)
  - Professor Of CS, Carnegie Mellon Univ.; Sloan Fellow
  - Winner: 2003 Computers And Thought Award; 2006 AAAI Innovative Applications of Artificial Intelligence
• Dr. Subhash Suri (Chief Algorithms Architect)
  - Professor of CS, University of California at Santa Barbara
• Dr. David Levine (VP, Research & Development)
  - Former Affiliate Professor of CS and Former Director Of The Center For Distributed Object Computing WUSTL
• Dr. George Nemhauser
  - A. Russell Chandler Chaired Professor in ISyE, Georgia Institute of Technology
  - Author Of The Standard Textbooks On Mixed Integer Programming

CombineNet Domain Expertise
• General (Ret.) Lester Lyles
• General (Ret.) Wesley Clark
• LTG (Ret.) Gus Pagonis
• Dr. Michael Goldblatt
  - Former Director of Defense Sciences - DARPA
Technologies

• **Expressive Commerce™**
  – Advanced Sourcing Application Platform – ASAP
  – Expressive competition
  – Expressive allocation evaluation

• **Combinatorial Optimization**
  – Hundreds of thousands – millions – of variables
  – Thousands of constraints, criteria, and/or business rules

• **Solving speed**
  – World’s fastest decision tree search algorithms
  – Solves most problems in seconds

**Optimization**
The ability to deal with the natural complexity of ever-changing markets, selecting the optimal decision available amongst the thousands, indeed millions of alternatives which deserve consideration

**Expressive Commerce™**
The ability to collaborate, capture and consider the alternative approaches to innovation, capacity, product/process creativity and cost/value leverage which may be provided by an increasingly sophisticated supply base
## CombineNet Approach to Decision Making

### Components

<table>
<thead>
<tr>
<th>Expressive Commerce™ – State-of-the Art Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>A richer, more collaborative marketplace for buyers and suppliers</td>
</tr>
<tr>
<td>Suppliers innovate to deliver their absolute best offers based on their strengths and your business needs</td>
</tr>
</tbody>
</table>

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<tr>
<th>Iterative Scenario Analysis – End-to-End Analysis</th>
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<tr>
<td>Uncover the cost trade-offs between must-have and nice-to-have business rules and criteria</td>
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<tr>
<td>Identify the difference between potential and implementable savings</td>
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<tr>
<th>Applied Optimization – Support Senior-Level Decision Makers with Timely Analyses</th>
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<tbody>
<tr>
<td>Analyze and compare potential award scenarios in seconds to find the optimal allocations</td>
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### Uses

<table>
<thead>
<tr>
<th>Sourcing</th>
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<tbody>
<tr>
<td>Transportation</td>
</tr>
<tr>
<td>Distribution</td>
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<tr>
<td>Raw Materials</td>
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<td>Finished Components</td>
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<td>Packaging</td>
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<td>Services</td>
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<th>Other</th>
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<tbody>
<tr>
<td>Resource Allocation</td>
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<tr>
<td>Network Design and Optimization</td>
</tr>
<tr>
<td>Option / Alternative Evaluation</td>
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</tbody>
</table>

- Created By The 10 Leading Experts
- Proven in Leading Companies
• **Express alternatives in significant detail** – offers, bids, capability...

• **Model decision maker's criteria, constraints, and business rules**

• **Conduct the event in a structured electronic environment**

• **Algorithmically match alternatives and criteria** – finely grained match to determine an optimal solution

• **Vary criteria and constraints** – scenario management – and re-optimize

---

**Control and exploit complexity**

• **CombineNet takes these highly expressive supply and demand statements…**
  
  – Automatically converts them into an optimization model;
  
  – Uses sophisticated tree search algorithms to solve the model; and
  
  – Sorts through the millions of options you could select to find the one you should select...quickly
Exclusive Advantages

• **Power**
  - Collect bids & alternative offers
  - Help suppliers to provide creative proposals
  - Suppliers avoid exposure risks – reduces hedging

• **Speed**
  - Quickly analyze & identify the best options
  - Iterate & compare alternatives rapidly
  - Model and quantify best value decisions

• **Usability**
  - Express stakeholder goals in biddable terms
  - Capture buyer and supplier side constraints
  - Find true cost of sourcing decisions – transparency
  - Find implementable solutions

• **Real World**
  - Comprehensive scenario creation and management
  - Real time change and situation modeling
  - Easily train and supervise less experienced procurement officials
  - Time to contract: months become weeks
  - Identify additional “hidden” savings and reduce program management costs

---

A Recent Sourcing Example:
- 3 major buyers
- 18,000 line items
- 259,533 bids
- 143,687 expressive bids
- 225 suppliers
- 2,910 Scenarios
- Average solve time <15 seconds/scenario
- Savings ~15% on $1B spend
Case Study: Sourcing in Quasi-Governmental Organizations

• **Challenge:** Transform supply chain to achieve significant cost savings
• **Solution:** Leverage CombineNet’s strategic sourcing technology across multiple portfolio groups to identify better, more cost effective vendor solutions
• **Results:**
  • Technology is transforming the USPS Supply Chain team through better, faster, more strategic decisions
  • Categories sourced include transportation (airfreight, ocean freight and holiday season truckload shipping), services (trash and recycling removal, vehicle wash), mail equipment materials (mail containers and pallet boxes), and fuel for fleet vehicles.
  • Enabled a transparent sourcing environment allowing objective, best value award decisions
• **Highlights:**
  • Roughly $1 billion in spend sourced through CombineNet software
  • 35X Return on Investment
  • Agreement recently renewed for 2 more years
Case Study: Improving Execution

• **Transportation lanes bundled by purchaser**
  – Groups of 600 lanes – origin/destination pairs
  – Grouped for convenience of buyer and simplifying decision-making

• **Outcome**
  – Grouping becomes “price of entry”
  – Encouraged hedging by suppliers
  – Forced over commitment by smaller suppliers and added cost by larger suppliers

• **Improvements from Expressive Commerce™**
  – Suppliers offer and group according to capability and best terms – suppliers play to own strengths and most efficient delivery
  – Suppliers focus on the components/segments where they excel
Case Study: Eliminating Unnecessary Constraints

- **Internal stakeholders required roll up doors on commercial trucks and trailers**
- **Expressive Commerce™ process permitted suppliers to offer alternative equipment (“bat wing” doors) and provided analytics to rapidly evaluate alternatives**
- **Clear financial advantage emerged indicating significant savings were achievable if the roll up door requirement could be relaxed**
- **Managers isolated the requirement and stakeholder and were able to change the requirement without affecting performance**
- **Outcome – multi-million dollar recurring savings**
Case Study: Advanced Sourcing Optimization in CPG Acquisition

- Large consumer products goods (CPG) company has used CombineNet since 2002 across dozens of direct and indirect areas of its purchasing.

- Highlights:
  - More than $10 Billion in Procurement spend to date
  - Growing to nearly 30%+ of total procurement spend
  - More than $1 Billion in identified savings

- Results:
  - Combinatorial optimization has allowed supply chain to model problems that were previously unsolvable
  - Leaner, yet more reliable supplier networks
  - Cost and service based competitive advantage
  - New best practices become retained organizational assets
CPG
2005 Transportation Review

- **Truckload rates are to increase 4.6%**
  - ~ matches the 2004 increase
  - others identify 6-15% increase
- **LTL rates to increase 4.3%**
  - ~ matches the 2004 increase
- **Air Cargo rates to increase 4.6%**
  - > double the 2004 increase
- **Ocean Freight rates to increase 3.9%**
  - Considerably less than 2004
- **Express and Parcel rates to increase 3.8%**
  - Less than any other mode
- **Why?**
  - Higher Fuel Costs
  - Capacity Shortages

• Estimated Transportation Cost Increase of 6-12% in 2006 for Fortune 500 companies – AberdeenGroup
• Shippers brace for higher fuel surcharges this fall – “Inbound Logistics”
Challenge: Support senior-level decision-makers with timely analyses
- Reduce total cost of North American Truckload transportation
- Balance price and non-price factors in award allocation (service levels, incumbency, etc.); improve supplier relationships
- Shorten bid processing cycle for quicker, more implementable results
- 8600+ lanes; more than 25,000 lane details; 148 carriers

Solution:
- CombineNet enables “Expressive Bidding” - allowing carriers to provide creative bids across any combination of lanes, equipment types, conditional offers, etc. – State-of-the-art technology
- CombineNet’s Scenario Builder enables the transportation sourcing team to view total transportation cost by lane and in aggregate based on analysis of carriers’ Expressive Bids against corporate business rules
- Includes price and non-price factors: carrier characteristics, capabilities, business preferences and customer requirements – End-to-end analysis

Results:
- Unconstrained savings: $71.4 million; 10% reduction in cost
- Implementable Savings: $33.4 million; 5% reduction in cost
- Bid processing cycle reduced from months to weeks
SCENARIO OVERVIEW

Current Scenario: Low Cost By Bus Unit - Key Units (1,2,3,4,8 & 12)

Scenario Scope
This scenario applies Everywhere

Results
- Total cost of this scenario: $133,532,883
- Scaled total cost: $133,532,883
- Historical Total Cost: $262,641,215
- Monetary savings: $129,108,332
- % savings: 49.2%
- Service Rating: 95.7%

Item Coverage

<table>
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<tr>
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<th>Total in Scenario</th>
<th>Number Awarded</th>
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<tr>
<td>Number of Lanes</td>
<td>1500</td>
<td>1492</td>
</tr>
<tr>
<td>Number of Carriers</td>
<td>145</td>
<td>77</td>
</tr>
<tr>
<td>Lanes Not Awarded</td>
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</table>

Total Cost By Carrier

The following Conditional Discounts triggered additional savings:

- Carrier A 5: If I am awarded at least 10 avg. loads per week in total, then I will reduce my price by 5 cents per mile everywhere.
- Carrier A 8: If I am awarded at least 3 avg. loads per week in total, then I will reduce my price by 5 cents per mile everywhere.
- Carrier A 9: If I am awarded at least 4.1 avg. loads per week in total, then I will reduce my price by 8 cents per mile everywhere.
- Carrier A 13: If I am awarded at least 3 avg. loads per week in total, then I will reduce my price by 5 cents per mile everywhere.
- Carrier B 16: If I am awarded at least 5 avg. loads per week in total, then I will reduce my price by 4 cents per mile everywhere.
- Carrier C 32: If I am awarded at least 10 avg. loads per week in total, then I will reduce my price by 10 cents per mile everywhere.
$22 Billion Global Household Goods Retailer

| Case Study: CPG Transportation and Distribution Network Optimization |
|---|---|
| **253 retail locations in 35 nations and more than 1,300 suppliers in 50 countries** | **Sourced Transportation By Mode/By Geographic Segment** |
| **Global supply chain lacked visibility, fostered silos in sourcing global transportation by region and mode** | **Highly Segmented and Fragmented Processes** |
| - EU Full Load, Part Load, NA Truckload, Ocean.. | **Competing Corporate vs. Regional Buying Strategies** |
| **Over 30 Stakeholders and 4 Business Groups** | **Desired to explore new sources of supply – Russia, Eastern Europe, China but did not have rates** |
| **Value of Contracts Sourced ~$1 Billion** | **Established systems and (manual) processes were unable to consider trade-offs across modes (ocean, land, air)** |
• Challenge – *Support senior-level decision-makers with timely analyses*
• Create single distribution system that optimizes mode selection and flow across the network
• Aggregate and source transportation spend across multiple tiers of their supply chain
• Change sourcing processes and strategy
CPG Door to Door with Carrier Supplied Drayage

- Factory
- Origin Port
- Destination Port
- Distribution Center or Store
But perhaps other origin ports should be considered, so…

allow carriers to propose an alternate origin port $\text{OP}_2$
also permit an alternate destination port DP₂
Next step: Add alternate land transportation to the origin ports and from the destination ports.
CPG Results

- Introduced repeatable, advanced sourcing best practice through adoption of self-service web application – State-of-the-art technology
- Introduced Innovative multi-tier supply chain sourcing process to understand implications and trade-off effects during the sourcing process – End-to-end analysis of mobility and transportation requirements
- Attained Global Rate Visibility to all equipment types in needed to use across all modes – End-to-end analysis of mobility and transportation requirements
- Reduced Sourcing time from months to weeks – Supports senior-level decision-makers with timely analyses
- Enabled stakeholders to represent and justify the costs of business needs – Supports senior-level decision-makers with timely analyses
Strategic Deployment Planning

- **How it's done today**
  - Strategic assets allocated at top level
  - User determines mode
  - Analysis based on transportation feasibility
  - Trial and error

- **Recognizing a better approach**
  - Aviation Battalion, 10th Mountain Division deployment to Afghanistan – Distribution Process Owner overrides user mode request
  - DPO optimizes mode selection to reduce cost, conserve strategic deployment assets while meeting or improving RDD

- **Is This Capability Needed on a Larger Scale?**
AT-21 Program Scope*

Modernize deployment and distribution planning business processes and provide decision support tools that produce optimal intermodal distribution solutions to drive efficiencies

**Deployment** (Annual)
- More than 590,000 people
- More than 640,000 short tons; 14,198,000 Sq ft
- 768 Origins
- 826 Destinations
- 331 Ports of embarkation
- 314 Ports of debarkation

**Sustainment**
- 32,000 truck loads/month
- 9,000 containers/month
- 10,000 463L pallets/month

**Complexity?**
- 768 Origins
- 826 Destinations
- 634,368 O-D pairs alone!

*Source: AT21 Industry Day Presentation, October 31, 2006*
Case Study (Force Readiness/Projection): Global Force Visibility Application

- **Optimal Troop Deployment while considering all real and potential constraints:**
  - Strategic guidance to prioritize/eliminate units for deployment
  - Comprehensive inventory of forces required to meet emergent and rotational requirements
  - Visibility of measured readiness for units to meet the requested force/capability.
Global Force Visibility, Deployment and Resetting the Force

**Force Readiness**
- Unit SORTS Measures:
  - Training levels
  - Personnel: Fill, and MOSQ levels,
  - Supply: Equipment O/H, Fleet
  - Maintenance
- Unit Capabilities/Missions
  - METL, JMETL
  - Capabilities
  - Availability
- Individual
  - TTHS Account
  - HD/LD MOSs
- PERSTEMPO/OPTEMPO
- Materiel
  - Supplies
  - Fleet
  - Commodity: fuel, water
  - TPFDD

**Strategic Mobility**
- Lift Capabilities: Railheads, Ports, and Airfields
- Lift Capacities: Transport (Truck, Air, Ship, Rail), Ports, Airfields
- Forces Deployment Visibility
- COCOM Plans OPLAN, CONPLAN, OPLAN
- TPFDD

Available → Train → Reset
**Optimizing the Equipment Challenge**

- **Mission**: Optimize Allocation of equipment among competing priorities to enhance readiness at lowest total cost of ownership

- **Variables**
  - Modernized equipment
  - Roll-down equipment
  - War reserve stocks/pre-positioned stocks

- **Business Rules**:
  - Favor redeploying units
  - Redeploying units get modernized equipment and transformation
  - Synchronize with training and deployment schedules
  - Match equipment of deploying units to prepositioned stocks
  - Match equipment to modernization / transformation plans
Mission: Optimize the allocation of transportation resources for strategic movement

- **Transportation Resources**
  - C-5, C-17, CRAF
  - RO-RO, Break Bulk...

- **Ports of Embarkation & Capacity**
  - Airfields
  - Ports

- **Transportation Capacity**
  - Amount of Cargo
  - Transit Time

- **Sequence of Delivery**
  - Time
  - Order

- **Ports of Embarkation & Capacity**
  - Airfields
  - Ports

- **Condition on Arrival**
  - Combat
  - Administrative

- **Force Attributes**
  - Personnel
  - Equipment
  - Cargo
  - Origin
  - Destination
  - Availability
A Possible Solution

- Use CombineNet’s Advanced Sourcing Application Platform optimize:
  - Distribution of resources – materiel, dollars, time – to meet force readiness, modernization and deployment goals and rules
  - Allocation of transportation resources to meet strategic deployment requirements while conserving time and money
- Employ CombineNet’s rapid scenario-building and solving capability to re-optimize allocation as constraints and requirements change
- Ability to vary rules, constraints, criteria…but also vary alternatives
Components Transportation
Asset Capabilities
- Individual asset capacity
- Availability / cost data
- "Lane" capacity & limitations by asset
  Submitted as "offer" to plan

ASAP Resource Allocation Application

Optimized Strategic Distribution Plan

Equipment Attributes
- Modernized
- Roll down
- Availability
- Cost
  Submitted as "offer" to plan

ASAP Intermodal Transportation Application

Optimized Strategic Transportation Plan

Transportation Plan Criteria and Requirements
- Personnel and cargo to be moved
- Time, pick up and destination requirements
- Sequence requirements
  Prepared as "scenarios"

Distribution Plan Criteria and Requirements
- Equipment distribution rules
- Constraints -- $, time...
- Sequence requirements
  Prepared as "scenarios"

Changes to criteria or requirements initiates dynamic re-plan and re-optimization

Taskings to components

ASAP
Intermodal
Transportation
Application

Component Transportation
Asset Capabilities
- Individual asset capacity
- Availability / cost data
- "Lane" capacity & limitations by asset
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ASAP Resource Allocation Application

Optimized Strategic Distribution Plan

ASAP
Intermodal
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Equipment Attributes
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- Roll down
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Transportation Plan Criteria and Requirements
- Personnel and cargo to be moved
- Time, pick up and destination requirements
- Sequence requirements
  Prepared as "scenarios"

Changes to criteria or requirements initiates dynamic re-plan and re-optimization

Taskings to components
Benefits

- Visibility to the Reset Problem
- Optimization and synchronization of resources

Functionality

- Models real world complex problems
- Supports Scenario-Driven “What-if Drills”
- Full transparency / encourages collaboration / eliminates unnecessary constraints
Conclusions

• Commercial best practice in use by the leading companies – State-of-the-art technology

• Capability to understand and exploit enormous complexity – End-to-end analysis of mobility and transportation requirements

• Detailed analyses orders of magnitude faster than other technologies – Support senior-level decision-makers with timely analyses