Logistics and Supply Chains

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Who am I?

• **Education**
  – BS/PhD, Civil Engineering, MIT
  – Cert. of Post Grad Study, Cambridge U., England

• **Research**
  – Facility location, logistics and supply chain, healthcare
  – 2 books

• **Service**
  – EIC, *Trans. Sci.*, *IIE Transactions*
  – President of INFORMS

• **Academic**
  – Prof, CE, U. Texas, Austin (78-79)
  – Prof, CE and TC, NU (80-85)
  – Prof/Dept. Chair, IEMS, NU (85-10)
  – Prof/Dept. Chair, IOE, U. Michigan (10-?)

All theory; no practice!
Outline

• What *was* logistics (1985)
• What have we accomplished
• Where might we go
• Relook – what *is* logistics
What *was* logistics?

• “... design and operation of the physical, managerial and informational systems needed to allow goods to overcome time and space.”

How have we changed?

- 30 years ago
  - THE vehicle routing problem
  - Simple heuristics
  - Artificial test problems

- Today
  - Multiple variants
    - Time windows
    - Stochastic demand
    - Stochastic travel time
    - Period VRP
    - Inventory VRP
    - Auctions for services
  - Numerous algorithms
    - Tabu search
    - Genetic
    - Simulated annealing
    - Ant algorithms ...
  - Real test problems

- Explosion of problem definitions
- More real-world modeling
- Test-bed for algorithmic development
- More thoughtful testing
How have we changed?

• 30 years ago
  – Location models
    • Set covering
    • Max covering
    • Median
    • Fixed charge

• Today
  – Location models
    • Integrated inventory-location models
    • Numerous other objectives
    • Tradeoff analyses
    • Reliability/Robustness/Resilience/Recovery
      – Random shocks
      – Terrorists
      – Demand Variability
    • Location-routing
    • Scenario planning
    • Use of real data

• Explosion of problem definitions
• Integration with tactical and operational decisions
• Test-bed for algorithms
How have we changed

• 30 years ago
  – Applications
    • Private sector
    • Emergency services
  – Objectives
    • Cost minimization
    • Profit maximization
      (sometimes)

• Today
  – Applications
    • Same but also
      • Humanitarian logistics
  – Objectives
    • Same but also
      • Equity and accessibility to services

• Greater interest in public sector logistics, broadly defined
• Inclusion of broader objectives
How have we changed

• 30 years ago
  – Integrated supply chain models virtually non-existent

• Today
  – Much integration of components
    – Reliability
    – Flexibility
    – Life-cycle/sustainability

• Logistics integrated with more business components
• Focus on reliability and life cycle product modeling
How has our world changed

• 30 years ago
  – Photography
    • Film
    • Prints or slides via mailers
  – Books
    • Hard copies only
  – Groceries
    • Local store only

• Today
  – Photography
    • Digital
    • Prints at home, drug store or via online orders
    • Multiple products
    • Online sharing
  – Books
    • Hard copies
    • Electronic versions
  – Groceries
    • Local store
    • Peapod-like services

Digital age reduces need for some logistics and creates new demands in other areas
Personal Aircraft
Future

- Inclusion of other corporate functions
  - Marketing
  - Demand forecasting
  - Sustainability of products and services

- Use of “big data” and analytics
  - Where are vehicles
  - Status of vehicles
  - Where is demand ... in an anticipatory manner
    - Weather → Demand → Logistics
  - Where are disruptions likely to occur

Proactive vs. Reactive Supply Chain Design/Operations
Future – wish list

• More real-world modeling
  – Problems → richer definitions
  – Data → problem definition, model structure, algorithm development, model testing

• Less emphasis on “optimal” solutions to idealized models;
  More on “improved” decisions in real world

• Reduced focus on “hard” or “random” instances;
  increased attention to real cases

• Continued development of creative algorithms
What is logistics?

• “... design and operation of the physical, managerial and informational systems needed to allow goods to overcome time and space.”

• “... design, management and operation of the physical, financial and informational systems needed to anticipate and satisfy customer needs through the timely, efficient and equitable delivery of goods and services.”
Questions or Comments