Logistics Overview: Trends, Challenges, and Opportunities Within the Industry

MITEF-TAG-MLIC
Georgia's Annual Forum on Leading Technologies
Winning in the Global Marketplace
2006 Featured Industry: Logistics

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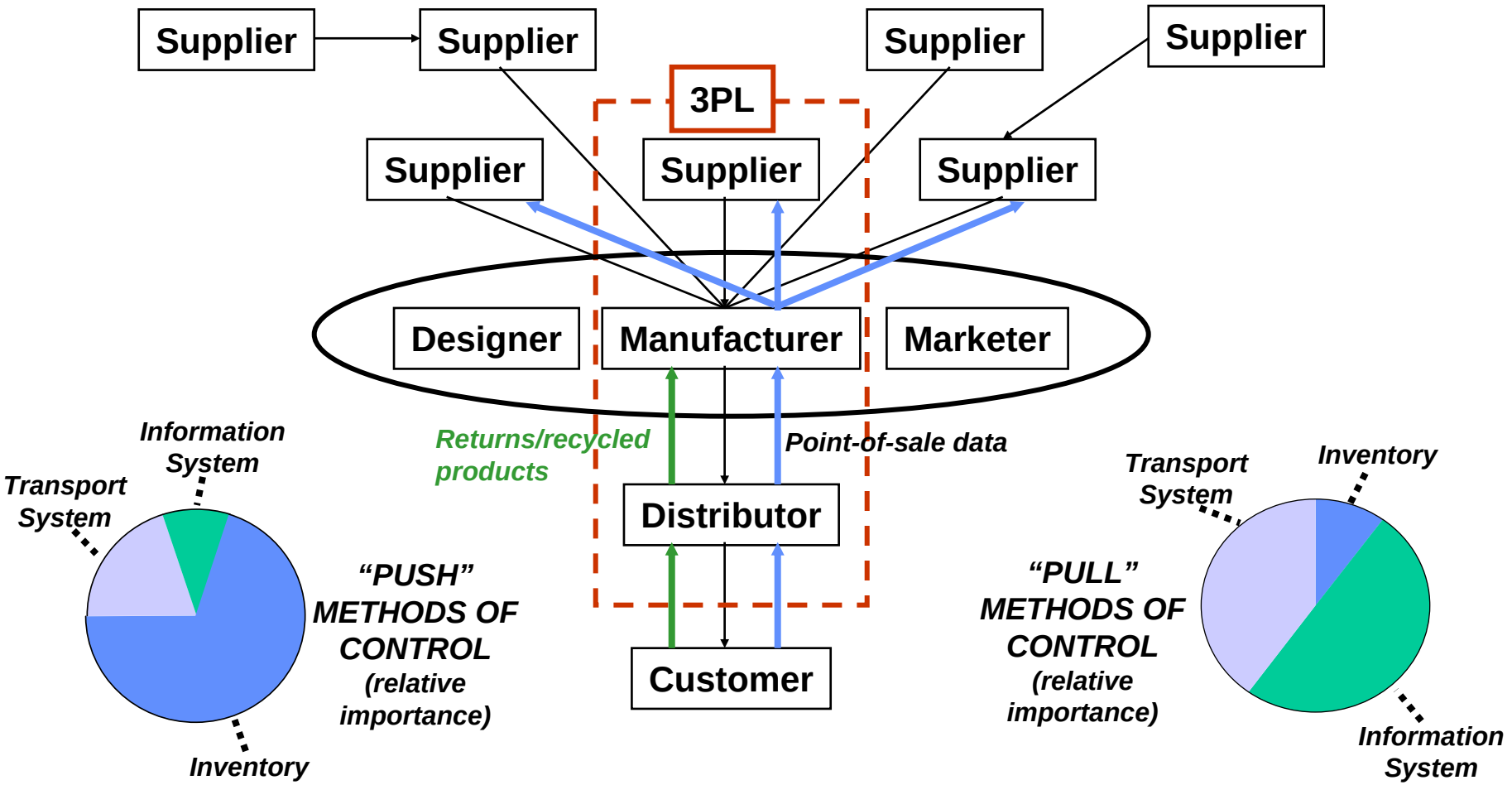
19 April 2006

Background

The Extended Enterprise

- The extended enterprise – network of independent companies with intent to respond to customers with better, less expensive products and technologies, faster to market. *Better, cheaper, faster*
- Supply chain – the flows of goods, information, and money in this network (definitions vary)
- Supply chains are designed and managed
  - Make or buy
  - Supplier selection and management

Supply Chain Systems



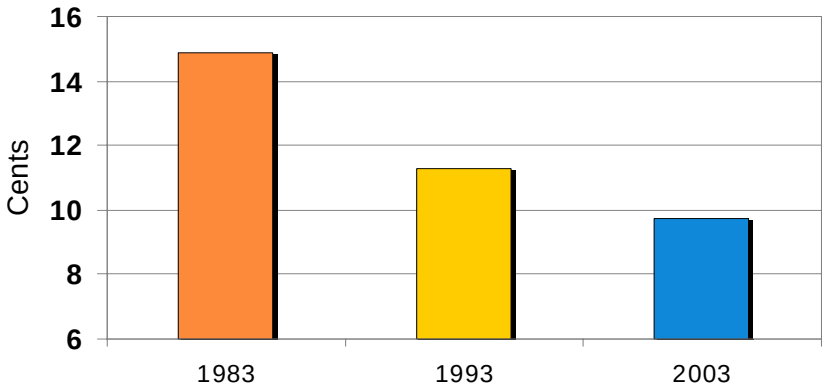
Trends

- Macro Trends
- Outsourcing & Offshoring
- Emerging economies – China, India
- Capacity Crisis/Congestion
- Industry Consolidation, Segmentation, & Expanding Services
- Resiliency, Risk Mitigation, and Reconfigurable Supply Chains
- Real-Time Control of Supply Chains

Macro Trends

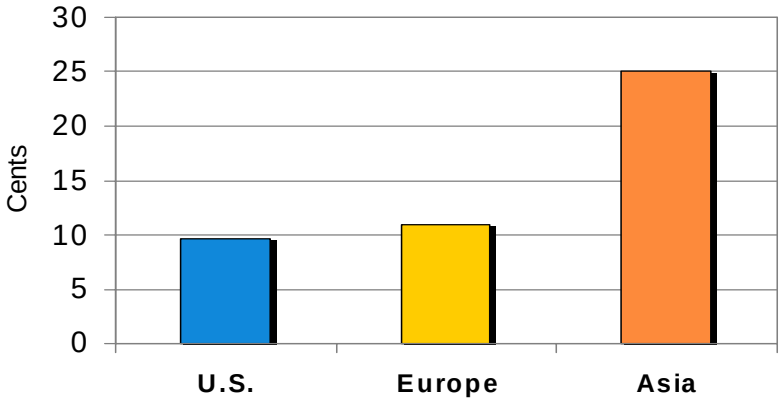
U.S. Logistics Performance Contributed to the Overall Economic Success in the 1990's

Logistics Expense per Dollar of U.S. GDP



Source: CLM, FTR

Logistics Expense per Dollar of GDP

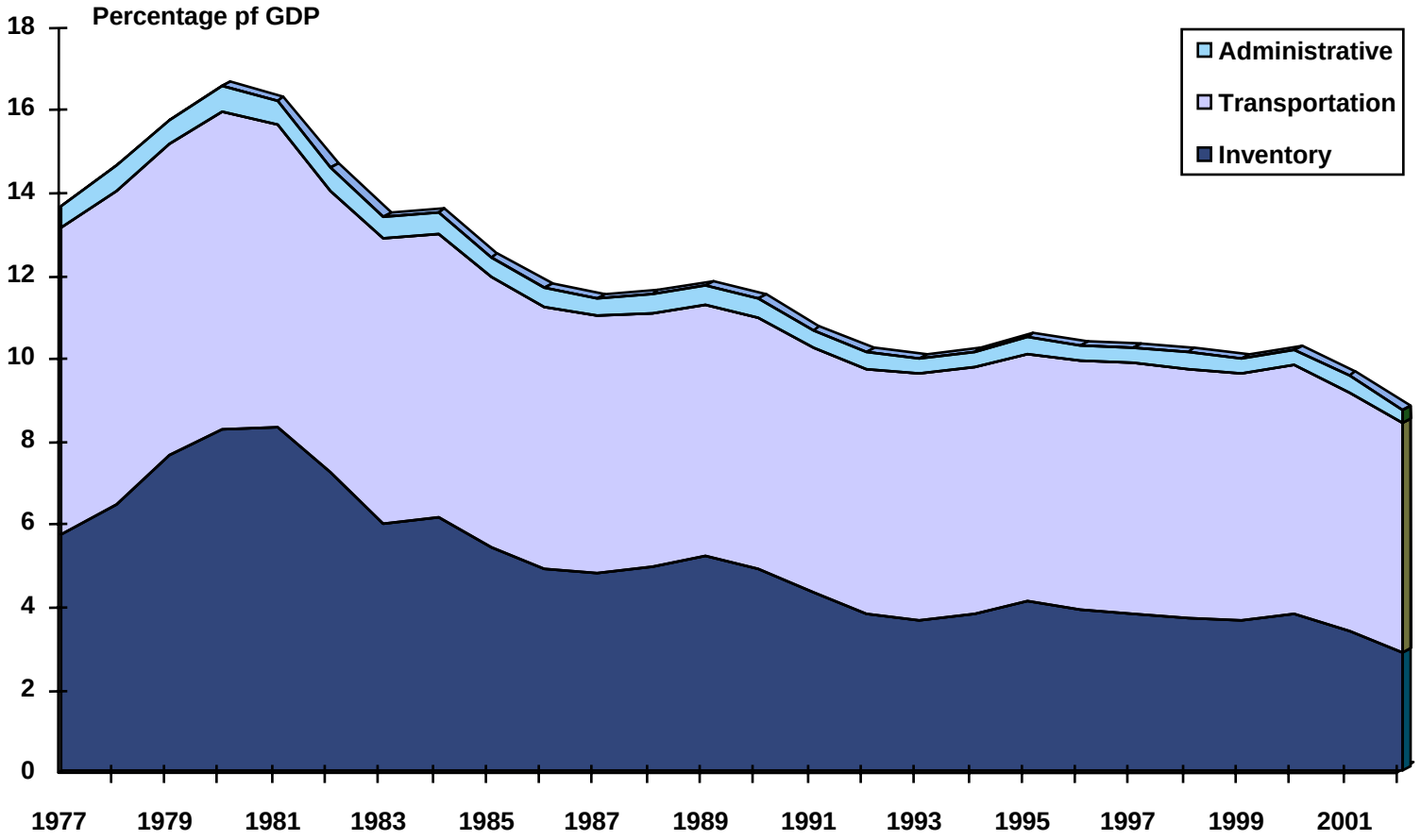


Source: JP Morgan, Bowersox

U.S. logistics are the best in the world. Our economic system and prosperity are unthinkable without it.

Impact of Economic Deregulation

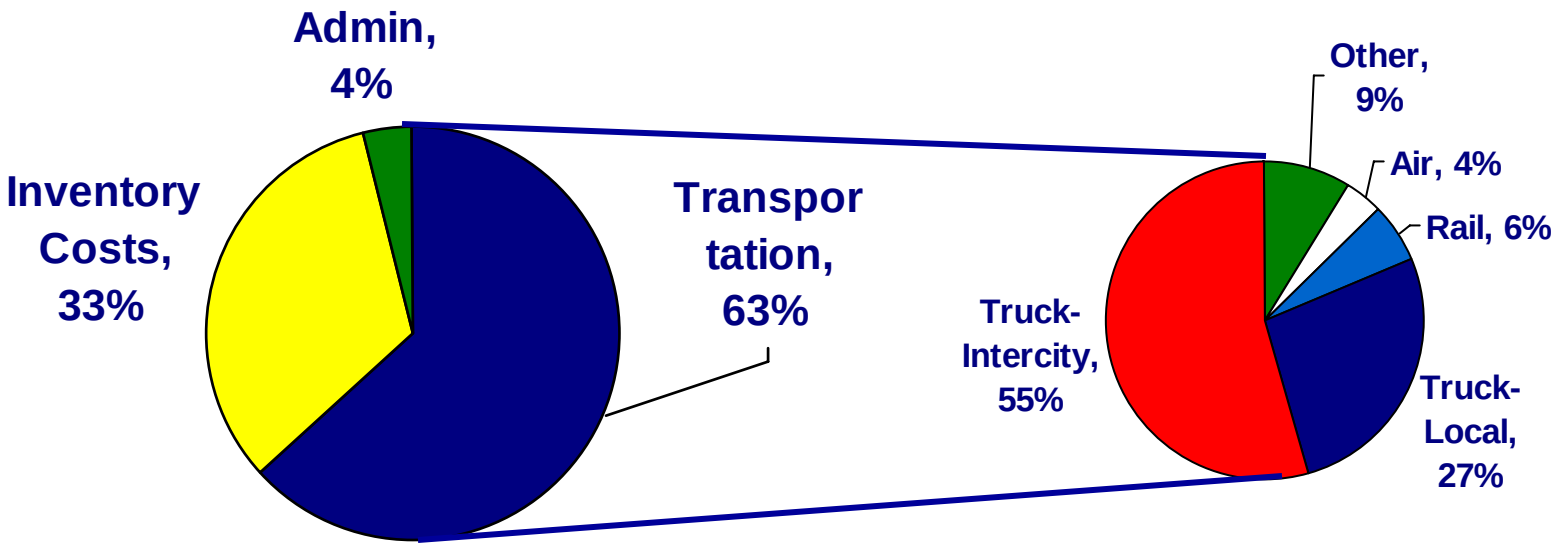
Total Logistics Expenditures and Gross Domestic Product (GDP)



Source: Cass Logistics.

CJL2

The U.S. Business Logistics System Cost is the Equivalent of 8.5 Percent of Current GDP in 2003



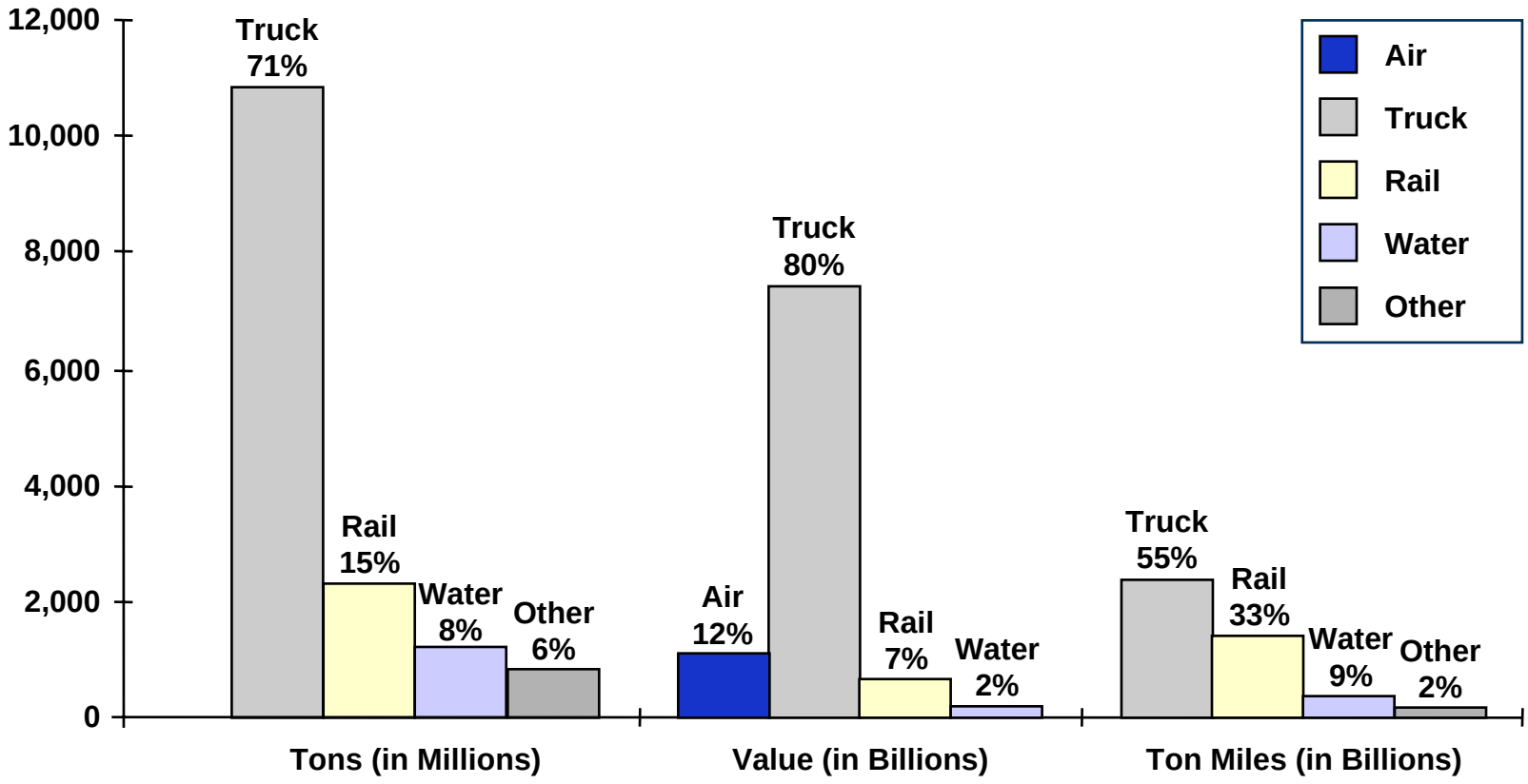
Total U.S. Logistics
$936 Billion

Transportation
$600 Billion

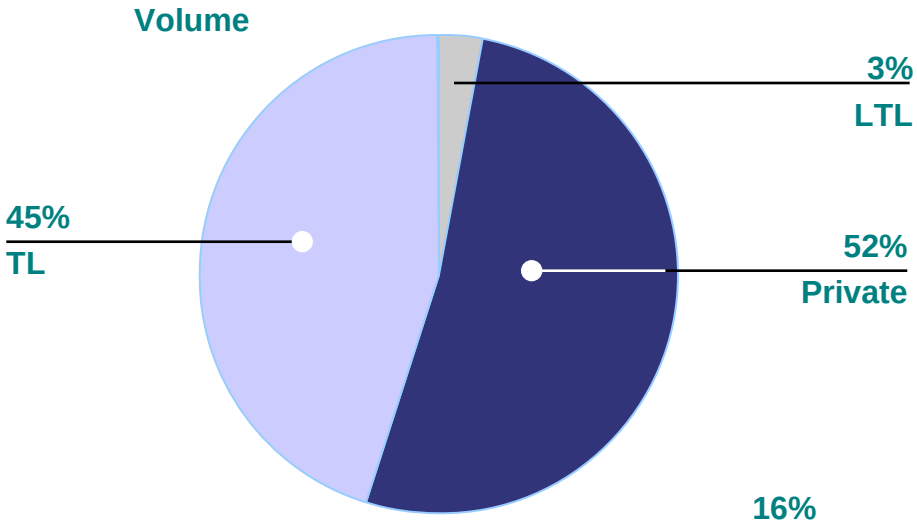
Source: CLM, 15th Annual State of Logistics Report, June 7, 2004.

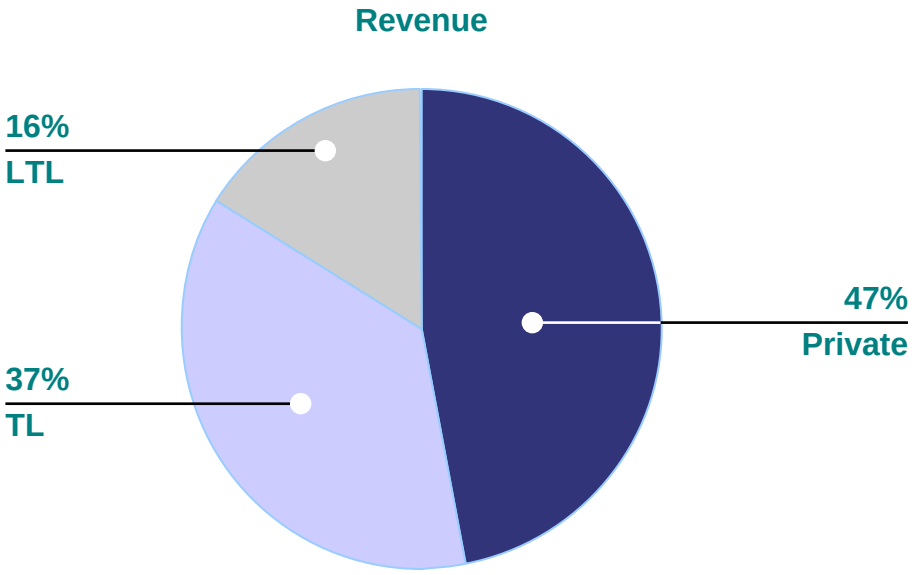
CJL2 C. John Langley, 1/5/2005

Freight by Mode



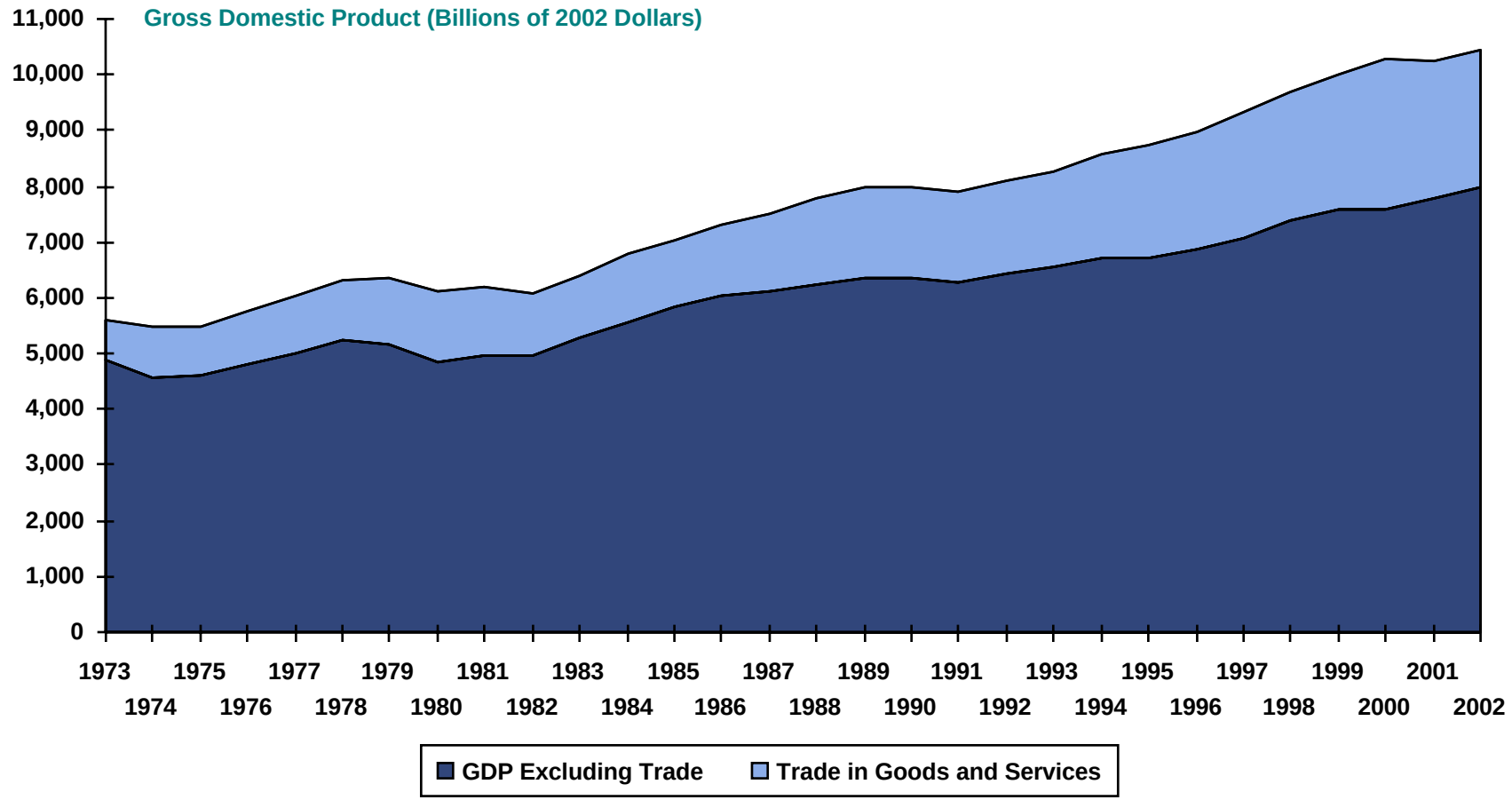
General Freight Shipments by Carrier Type





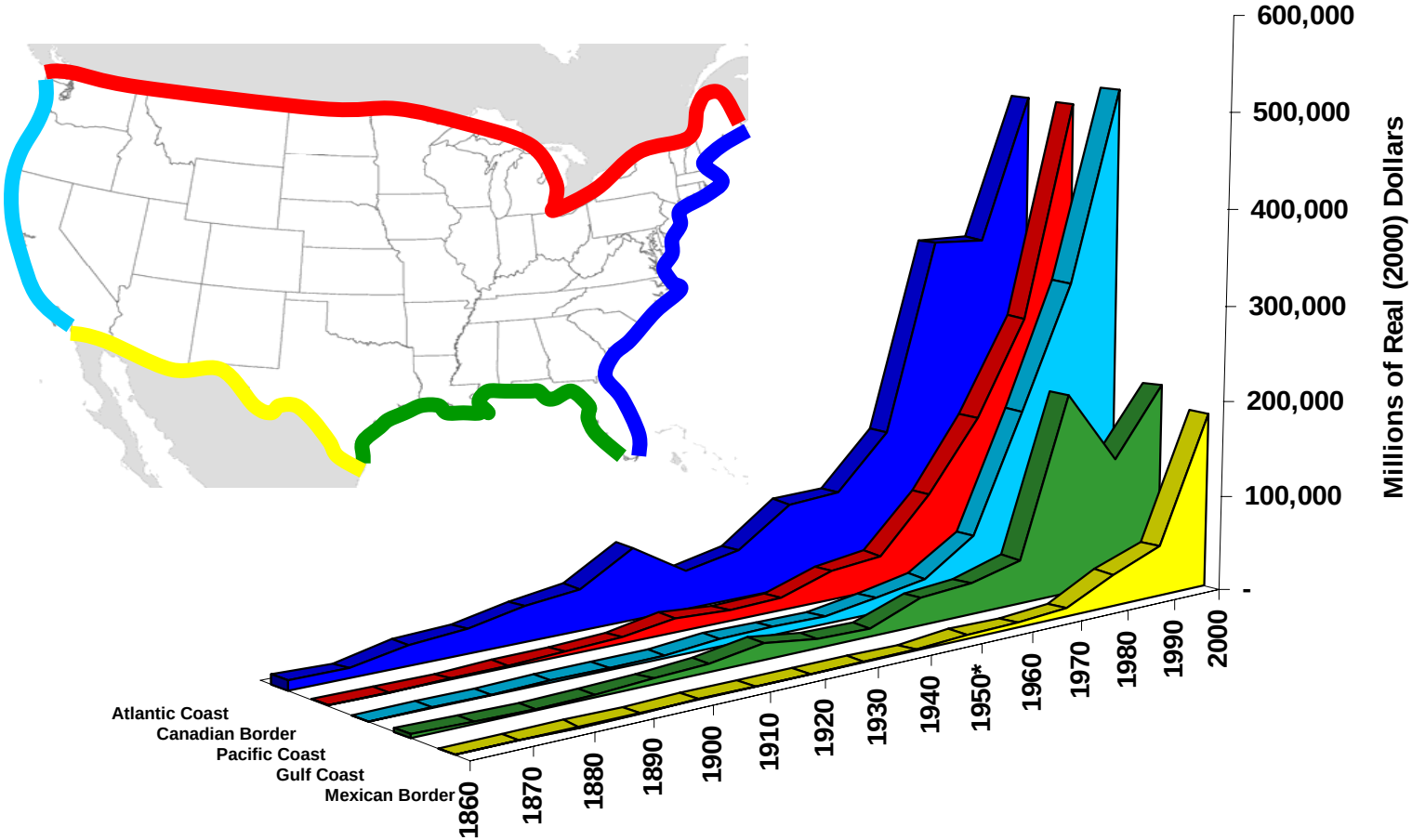
Supply chains are becoming more global & more complex

U.S. GDP & Trade History



Source: Bureau of Economic Analysis data available at International Trade Administration, http://www.ita.doc.gov/td/industry/otea/usfth/tabcon.html.

Entry Coasts

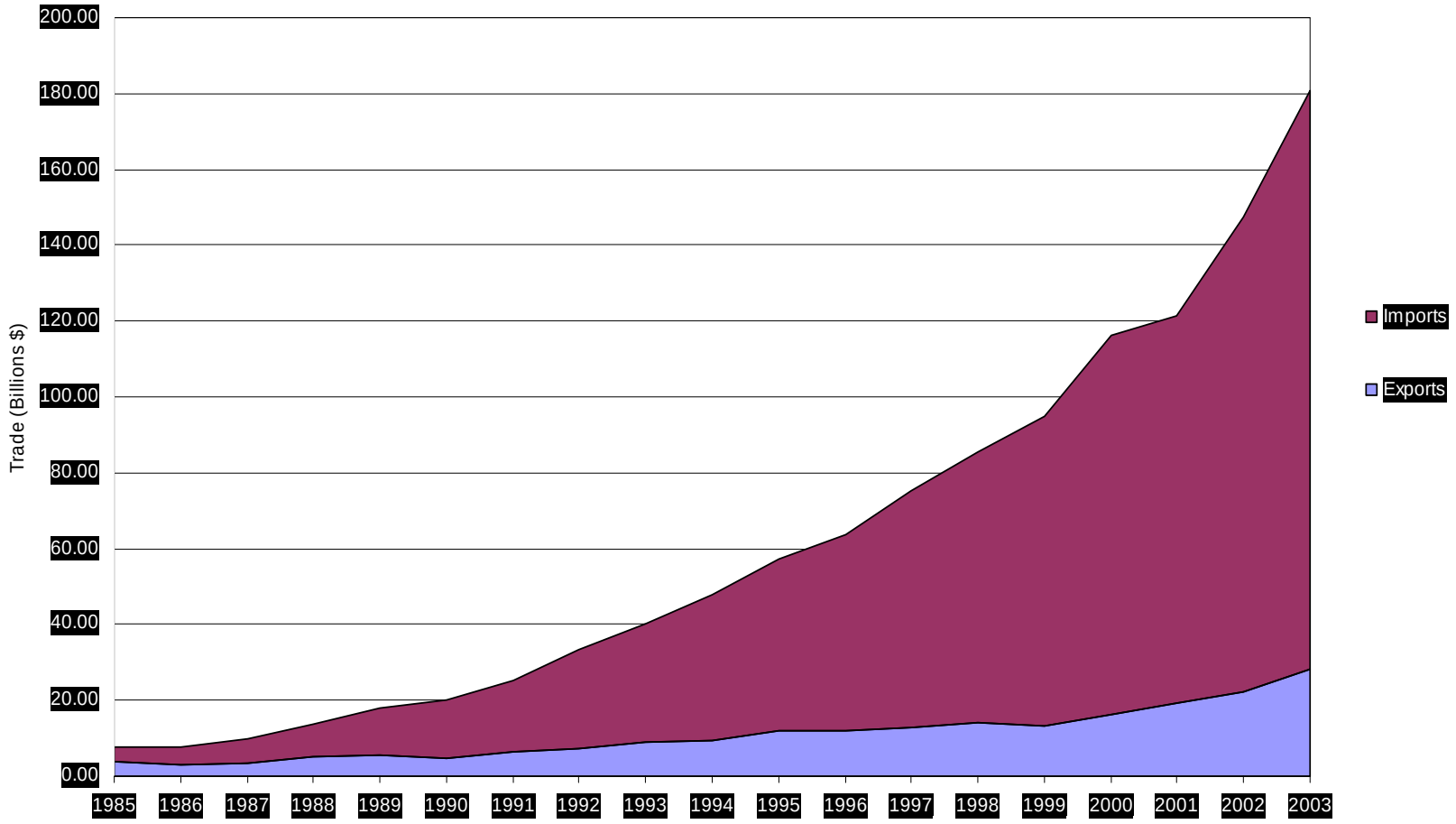


Global Logistics Market

	Population (billions)	GDP ($ trillion)	Logistics ($ billion)	% of GDP	Outsourced Logistics ($ billion)	% of Logistics Outsourced	Estimated Growth of Outsourced Market
United States	0.4	11	936	9%	77	8.2%	10-15%
Europe	0.5	10	900	9%	68	7.5%	10-15%
Asia-Pacific (x-China)	0.6	5	600	12%	30	5.0%	15-20%
China	1.3	1	230	23%	5	2.2%	20-25%
Global	6.1	31	3,500	11%	197	5.6%	10-15%

Source: Armstrong %& Associates, Cass Information Systems, International Monetary Fund, Mercer Management Consulting, Organization for Economic Cooperation and Development, The World Bank Group, Robert W. Baird & Co. Estimates.

Growth of China Trade



China Production

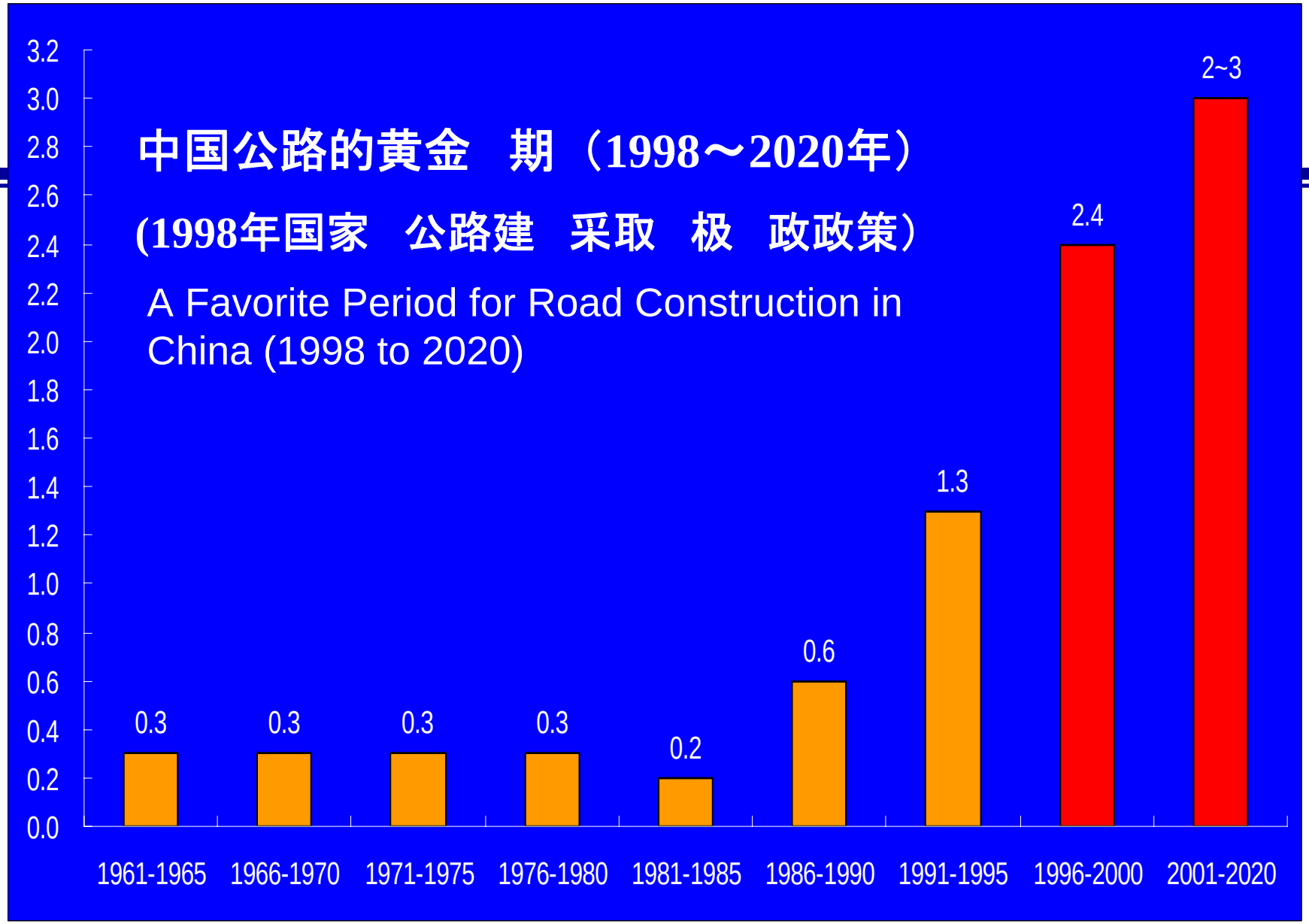
- China is the "world's largest factory" in the early 21st century, producing:
  - More than 50% of the world's cameras
  - 30% of the air conditioners and TVs
  - 25% of washing machines
  - Almost 20% of refrigerators
  - More than 33% of DVD-ROM drives and personal desktop and notebook computers
  - About 25% of its own mobile phones, color TVs, personal digital assistants, and car stereos

Note: Information on this page is based on December 2003 issue of Foreign Affairs

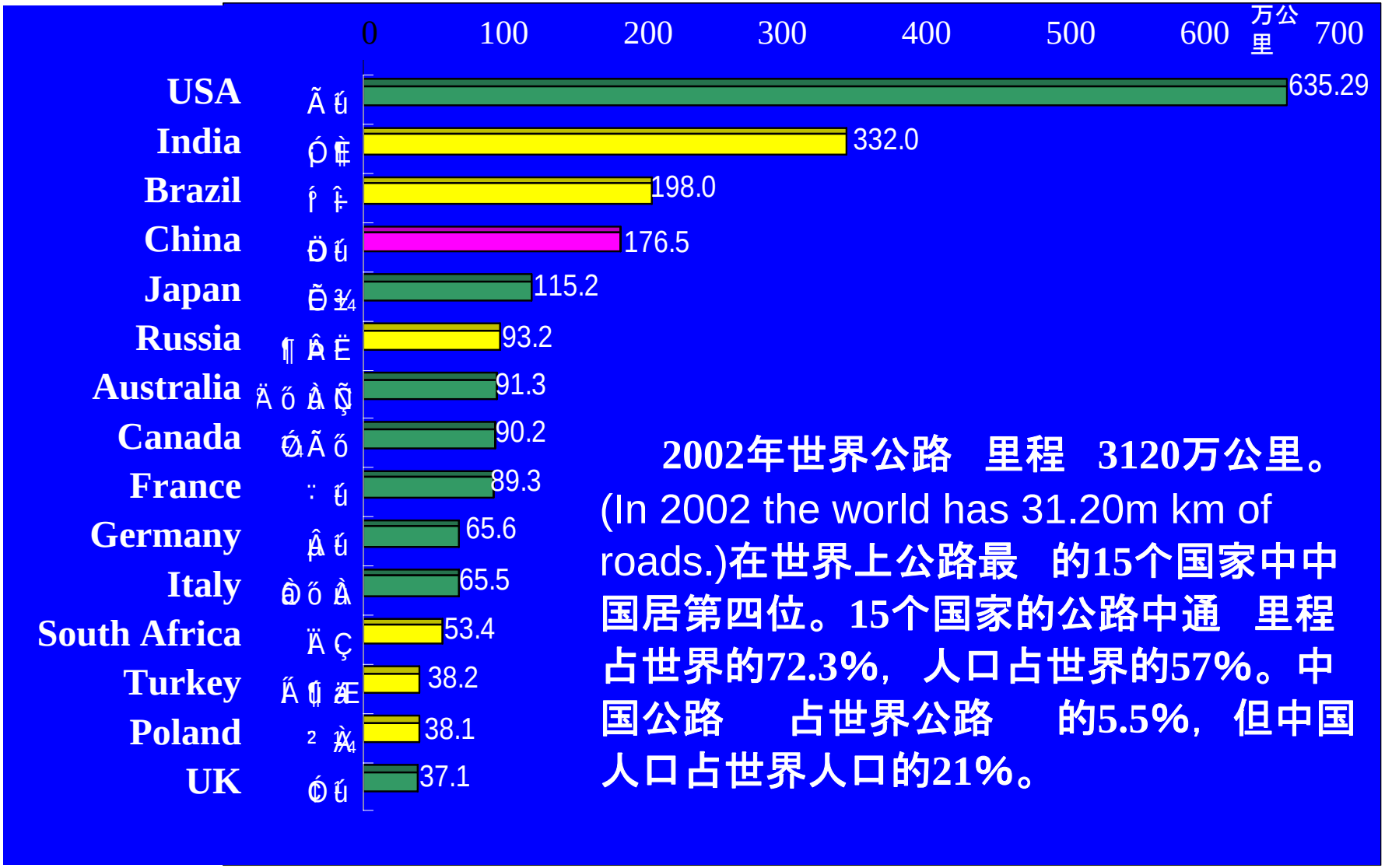
China Consumption

- Consumption rate grew annually at about 8.8% to 10.1% from 2000-2003
  - Color televisions sets in almost every urban home
  - Refrigerators and washing machines in more than four out of five homes
  - Videodisc players and air conditioners in 50% of homes
  - Microwave ovens in almost 1/3, computers in one out five
  - Biggest market for cell phone with 200 million in use

Reference: December 2003 issue of Foreign Affairs


中国公路的黄金　期（1998～2020年）
(1998年国家　公路建　采取　极　政政策）
A Favorite Period for Road Construction in China (1998 to 2020)
占GDP比重(%)
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.3
0.3
0.3
0.3
0.2
0.6
1.3
2.4
2~3
1961-1965
1966-1970
1971-1975
1976-1980
1981-1985
1986-1990
1991-1995
1996-2000
2001-2020

*我国公路　已达到176.5万公里，居世界第四位。（不包括全国11万公里的城市道路）**Lane kilometers in China totals 1.765m km, which ranks the 4th in the world (excluding 0.11m km urban roads)***



2002年世界公路　里程　3120万公里。(In 2002 the world has 31.20m km of roads.)**在世界上公路最　的15个国家中中国居第四位。15个国家的公路中通　里程占世界的72.3%，人口占世界的57%。中国公路　占世界公路　的5.5%，但中国人口占世界人口的21%。**

Yangshan Terminal Location

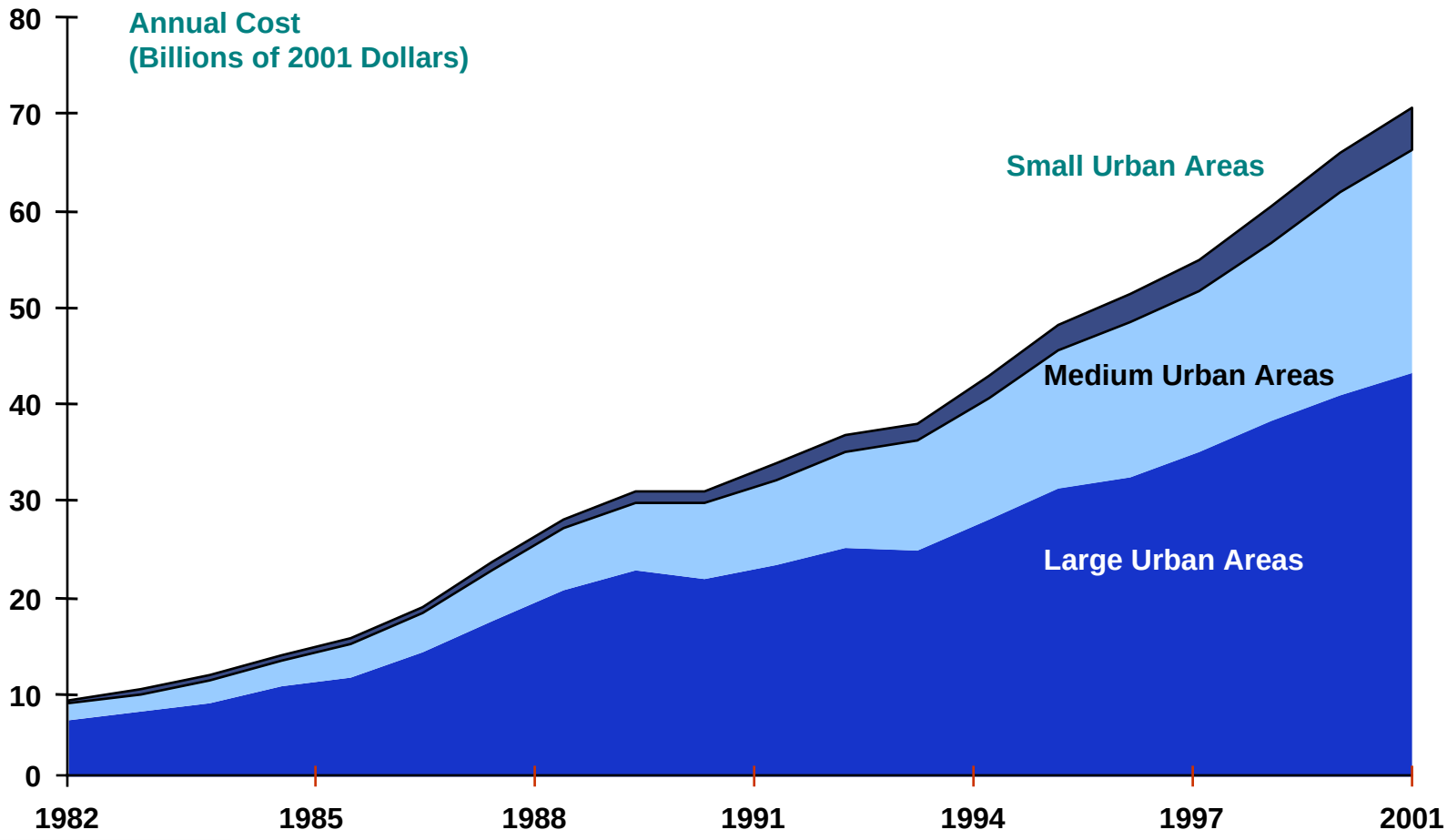
Terminal, Bridge, & Logistics Park

- Container Terminal – about 50 berths
- Bridge – 31km
- Logistics Park – 14 km^2
- Port New City – 800,000 population

Luchao Logistics Park Layout

Movement of more people & goods creates congestion & leadtime uncertainty

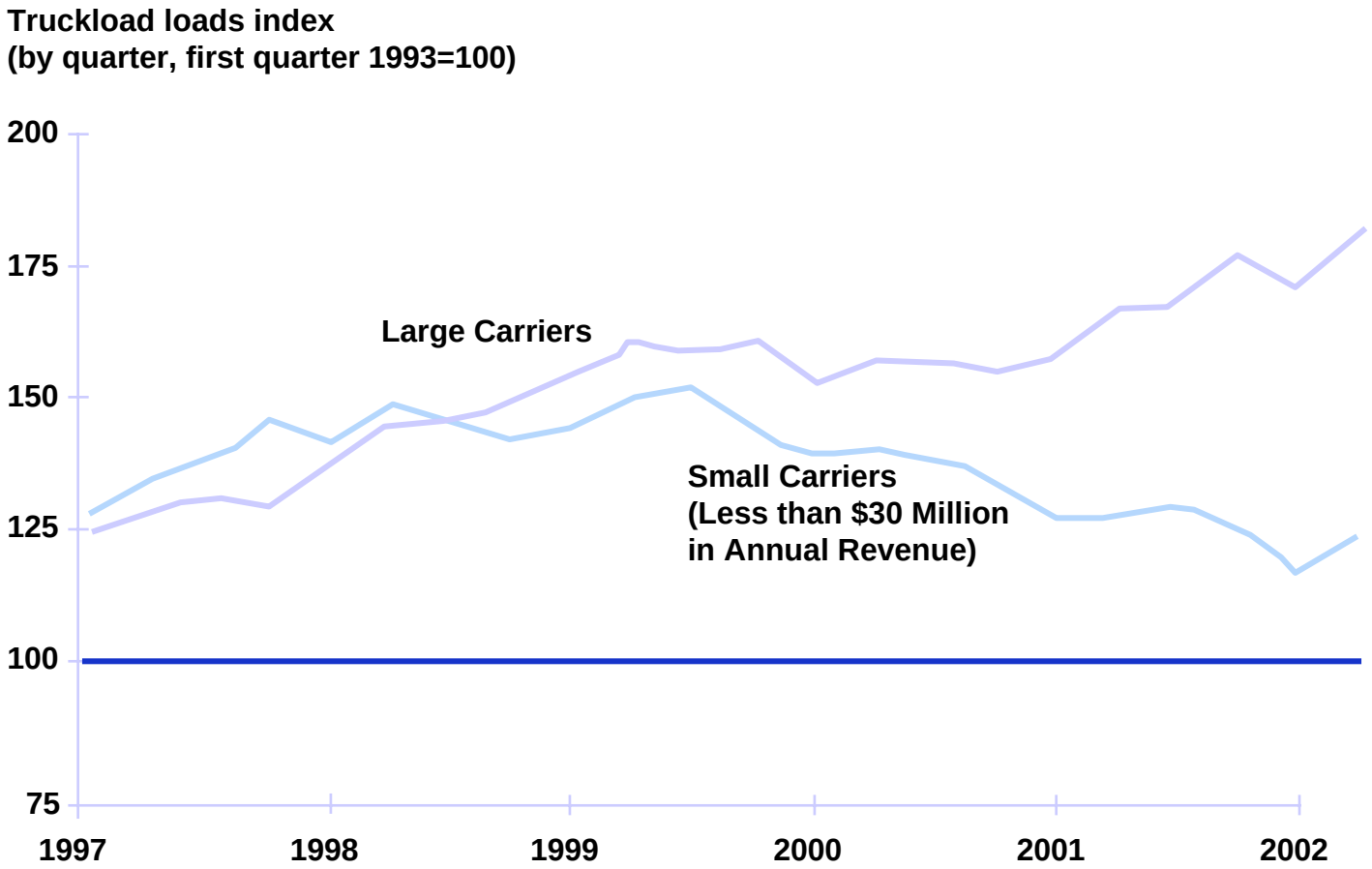
Annual Congestion Costs



Source: Texas Transportation Institute (TTI).

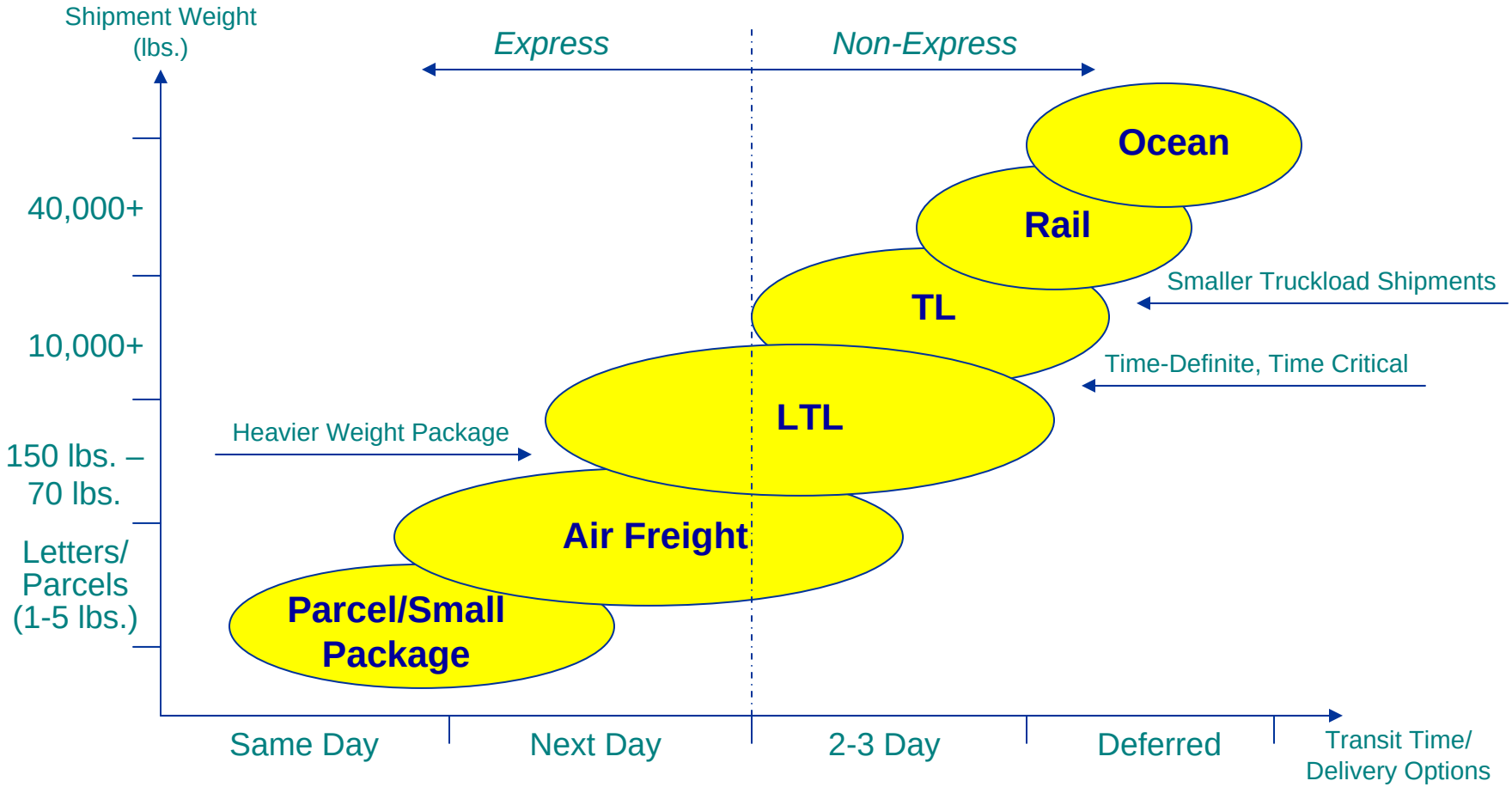
Consolidation & Segmentation

Trucking Industry Consolidation



Source: American Trucking Associations.

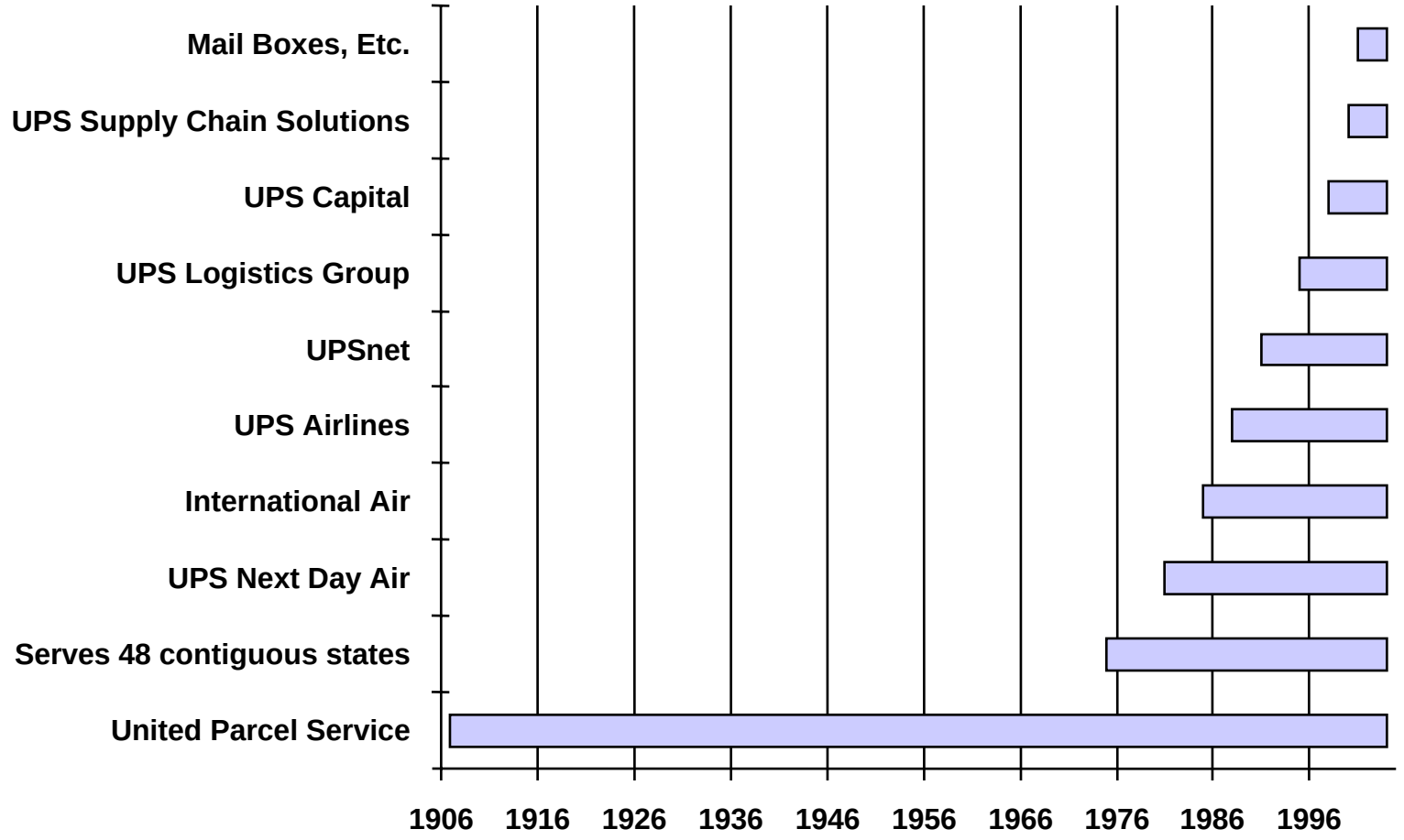
Freight Modes
"Blurring" Lines of Distinction



Source: Bax Global.

Expanded Services

Example: UPS Service Expansion



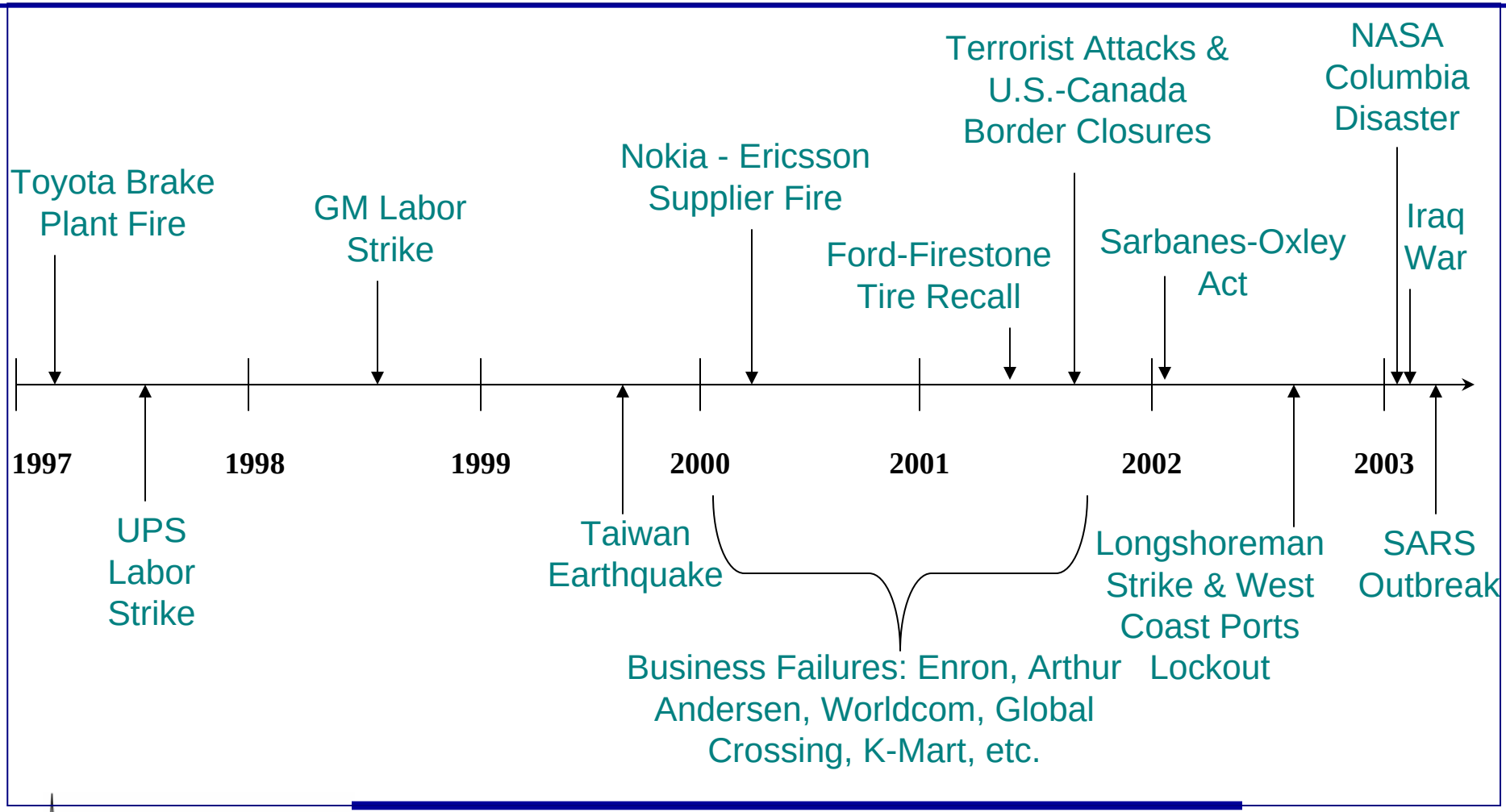
UPS Expanded Services

- "Your world synchronized" – from messenger service to dynamic supply chain manager.
- Toshiba: UPS picks up and delivers PCs in need of repair, but also repairs them.
- Papa John's: UPS dispatches the PJ supply truck drivers and schedules the pickups of supplies, such as tomatoes, pizza sauce, and onions.
- Nike: UPS picks, inspects, packs, and delivers shoes; manages the warehouse.
- Jockey: UPS manages products at a UPS warehouse, fills the order, bags it, labels it, and delivers it.
- HP: UPS manages the replacement parts and repair divisions in Europe and Latin America.

Reference: Friedman The World is Flat, 2005

What is 'resiliency' and why consider it?

Supply Chain Disruptions



Supply Chain Productivity vs. Resiliency

- How to design a supply chain to “degrade” gracefully when faced with major disruptions? Sourcing implications.
- How to ‘shock-proof’ a supply chain?
- Challenges:
  - The design of reconfigurable supply chains. Redirecting the flow of goods in a freight transportation network if a node (e.g., sea or air cargo port) or link (e.g., Panama Canal) is disabled or lost.
  - The impact of new U.S. security initiatives on the productivity of the nodes and links in the freight transportation network and the supply chains that use this network.

Real-time Control of Supply Chains

Where do the data come from?
Data sources

- Inventory levels
- Production rates
- Vehicle, vessel, or trailer
  - Position
  - Speed
  - Direction
  - Temperature
  - Oil or air pressure
- Driver alertness
- Traffic congestion
- Weather
- Freight status & visibility

Sensors, Data Transmission, & Information Processing

Question

Can real-time control of a supply chain, based on real-time data, result in a more:

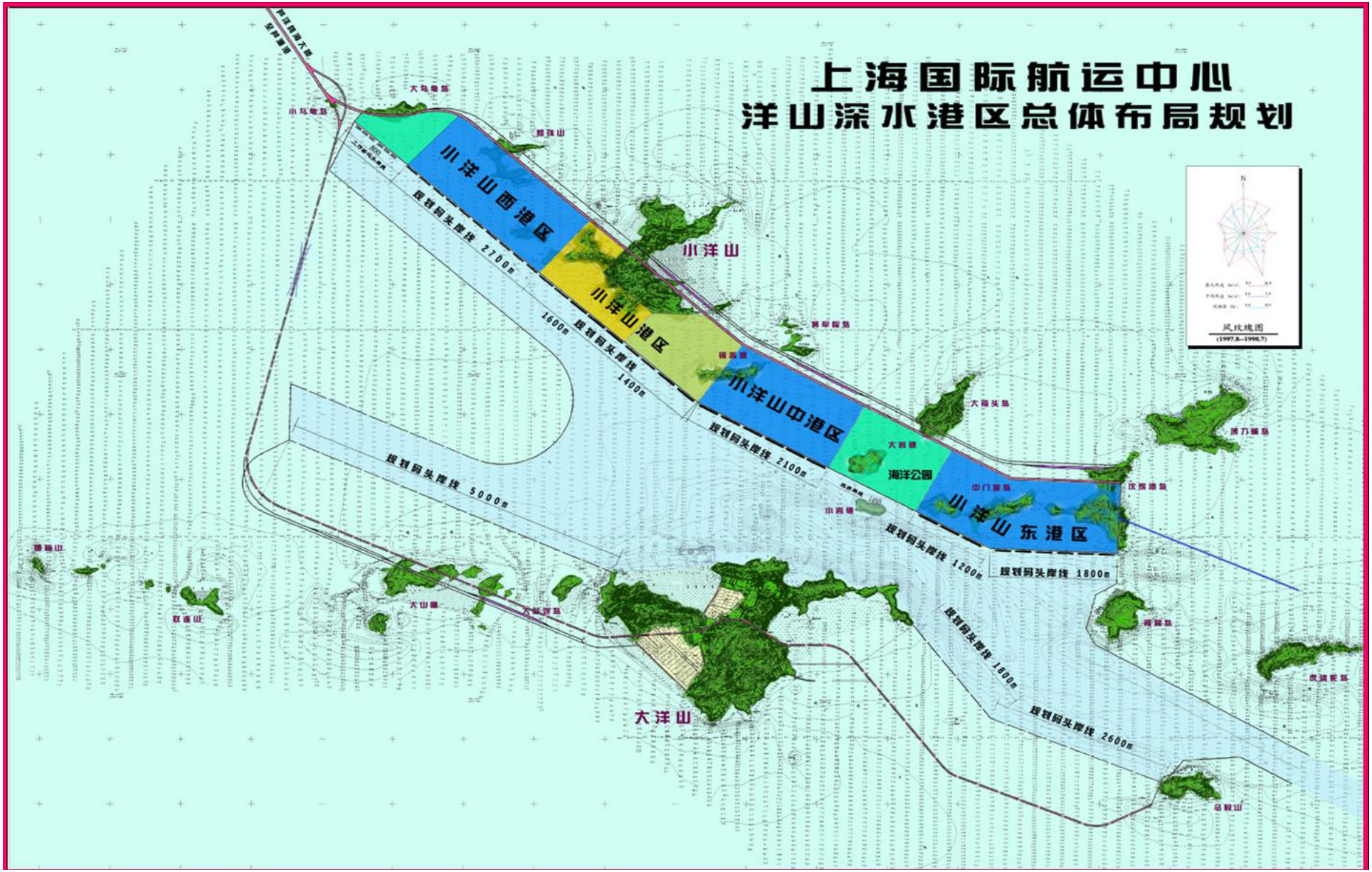
- Productive
- Resilient (secure)
- Stable

supply chain?

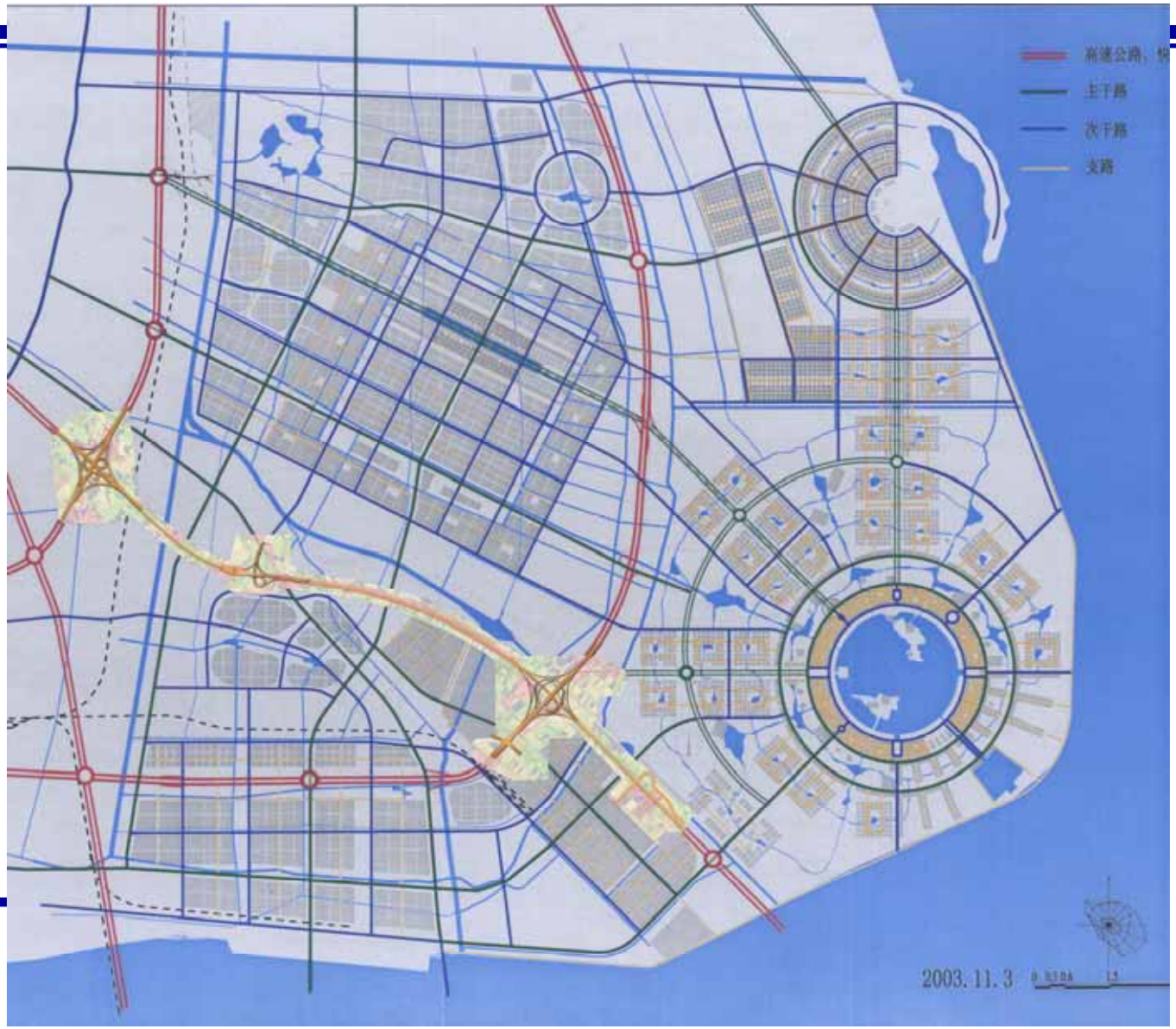
Questions?

Thank you!

Container Terminal Layout



Port New City



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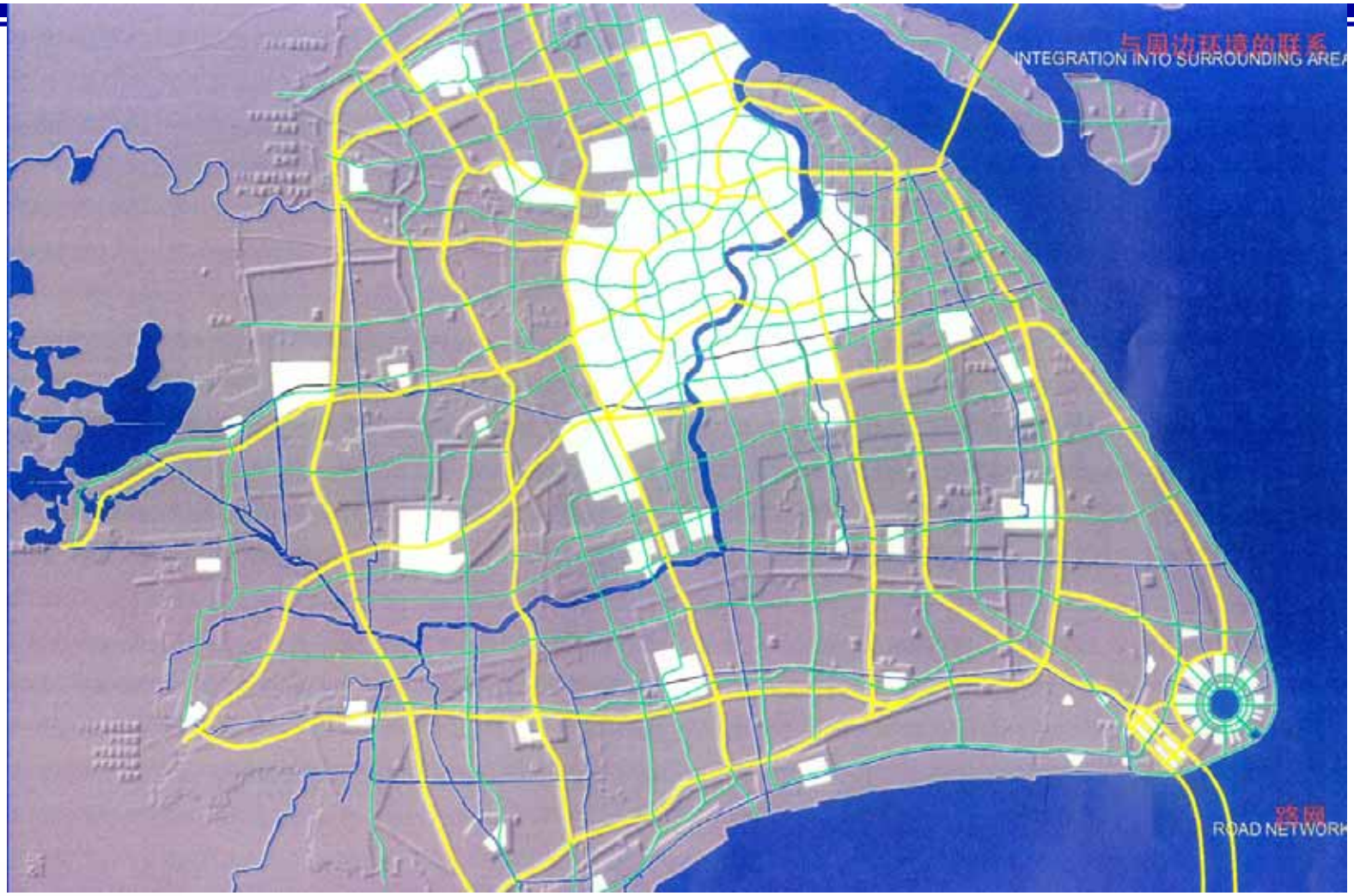
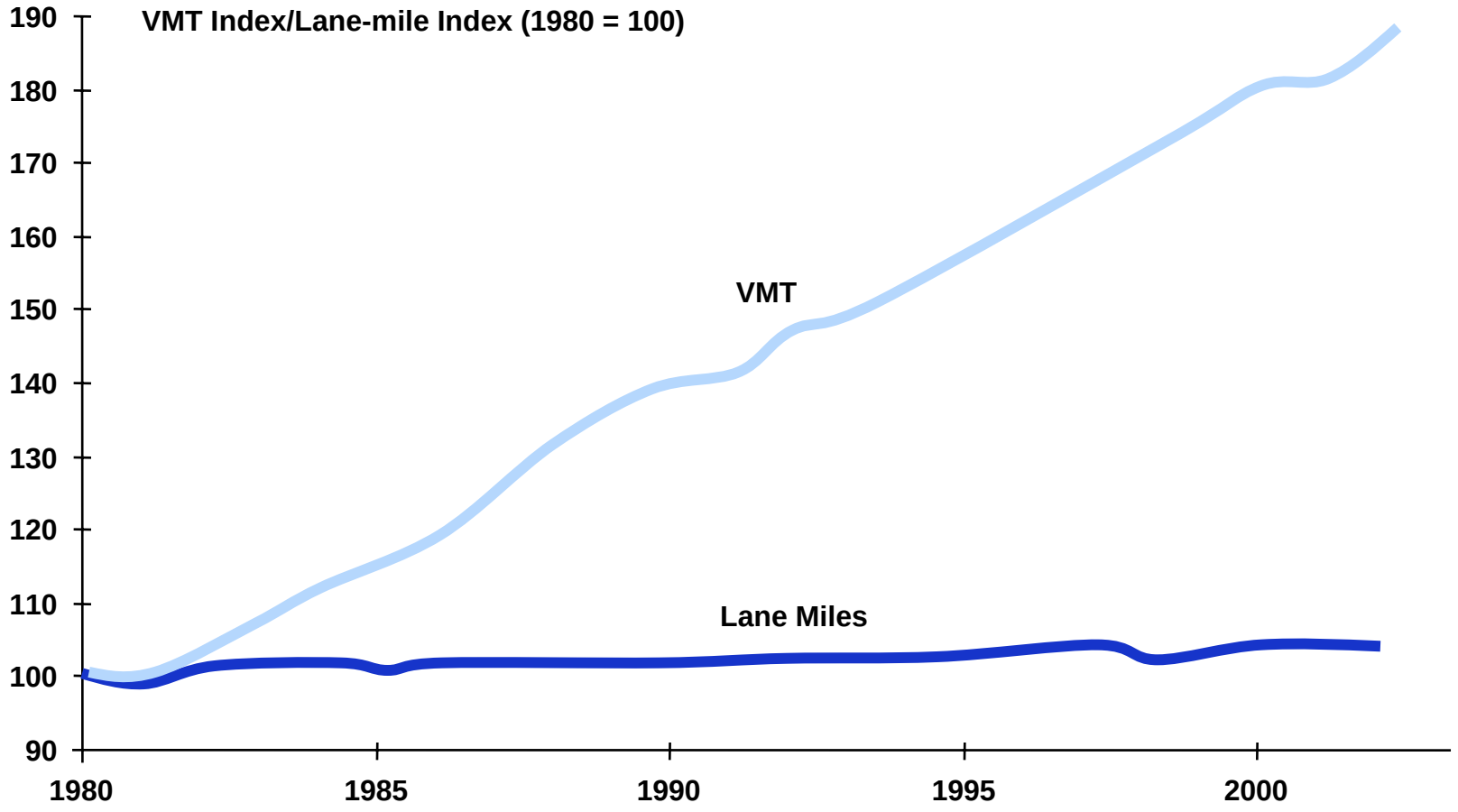
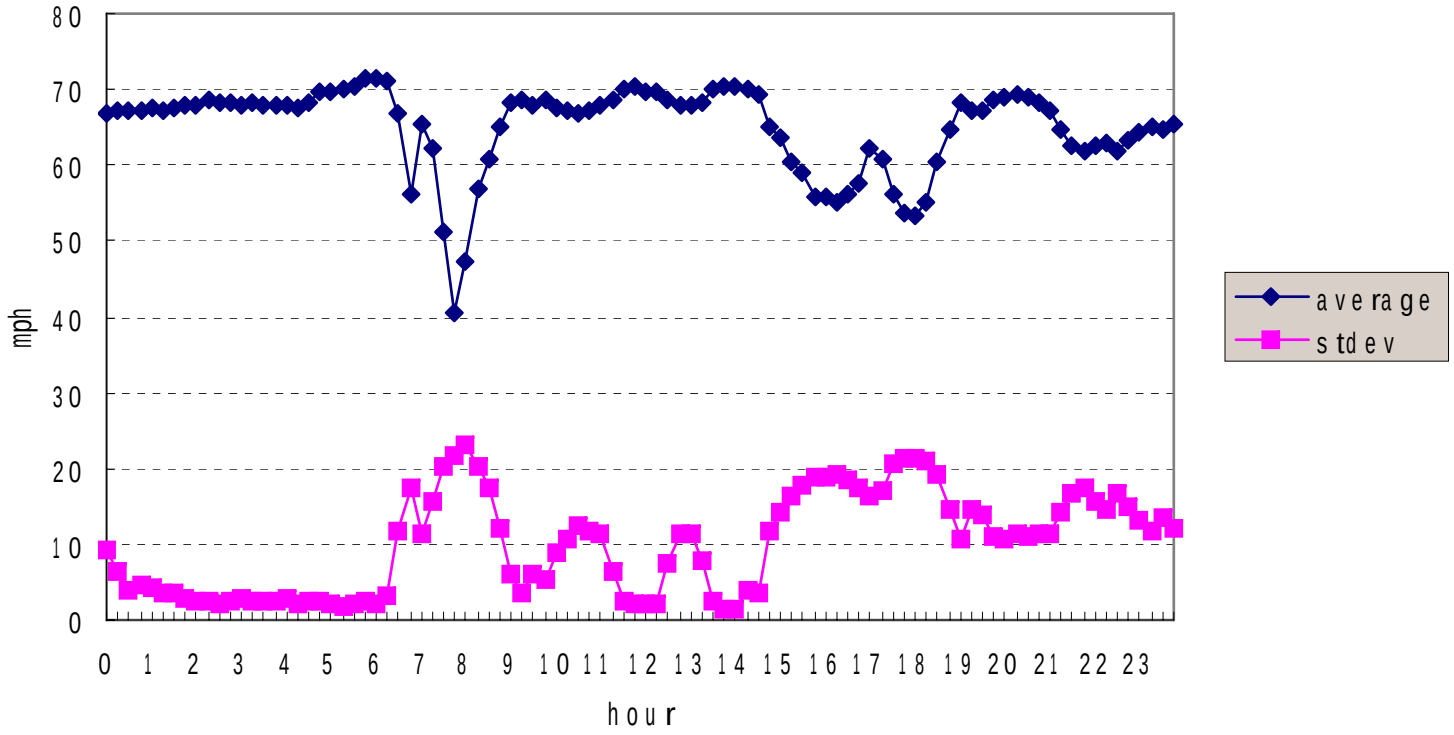
Highway Transportation Plan



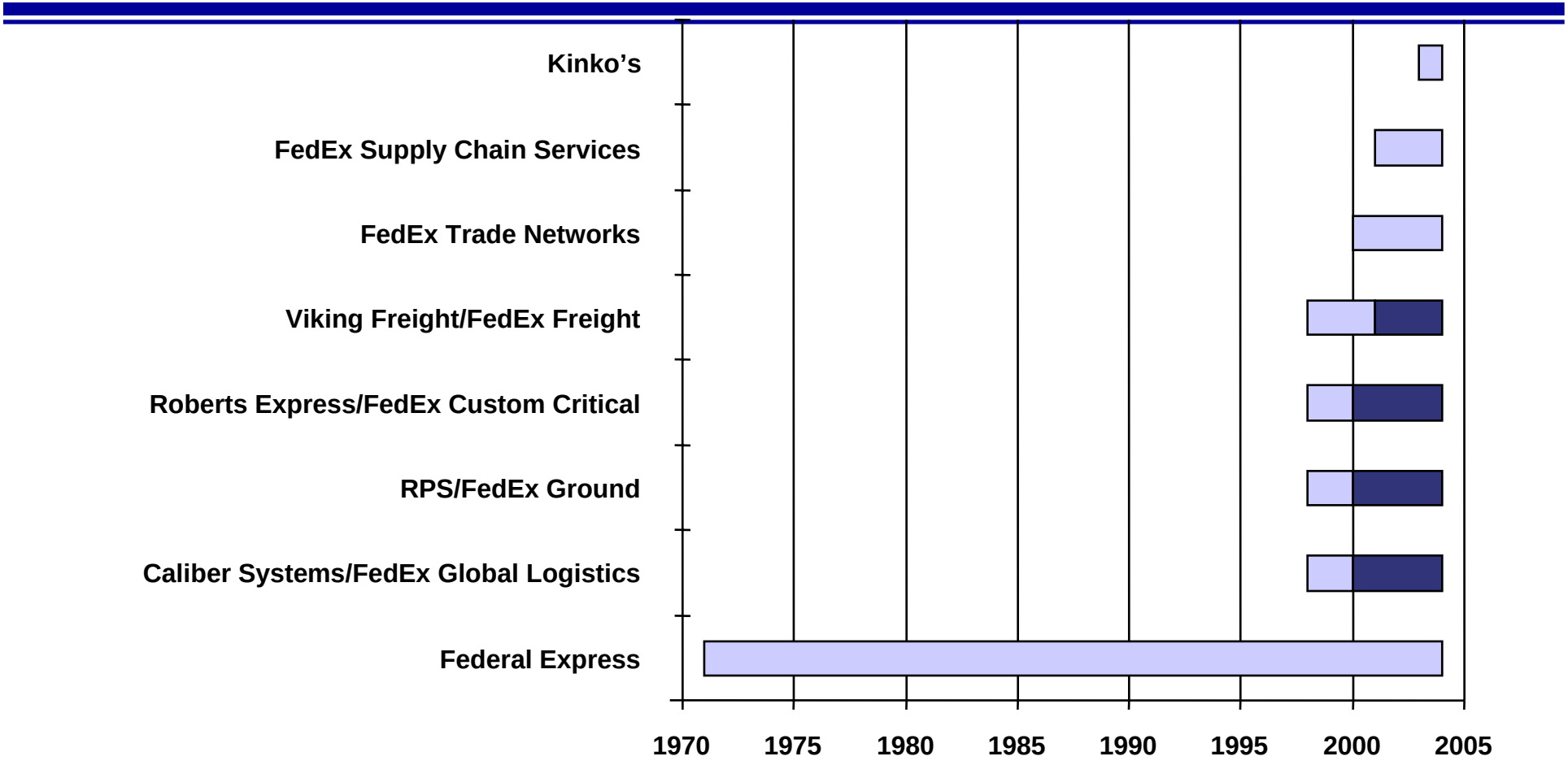
Vehicle Miles of Travel & Lane Miles



Congestion & Leadtime Uncertainty

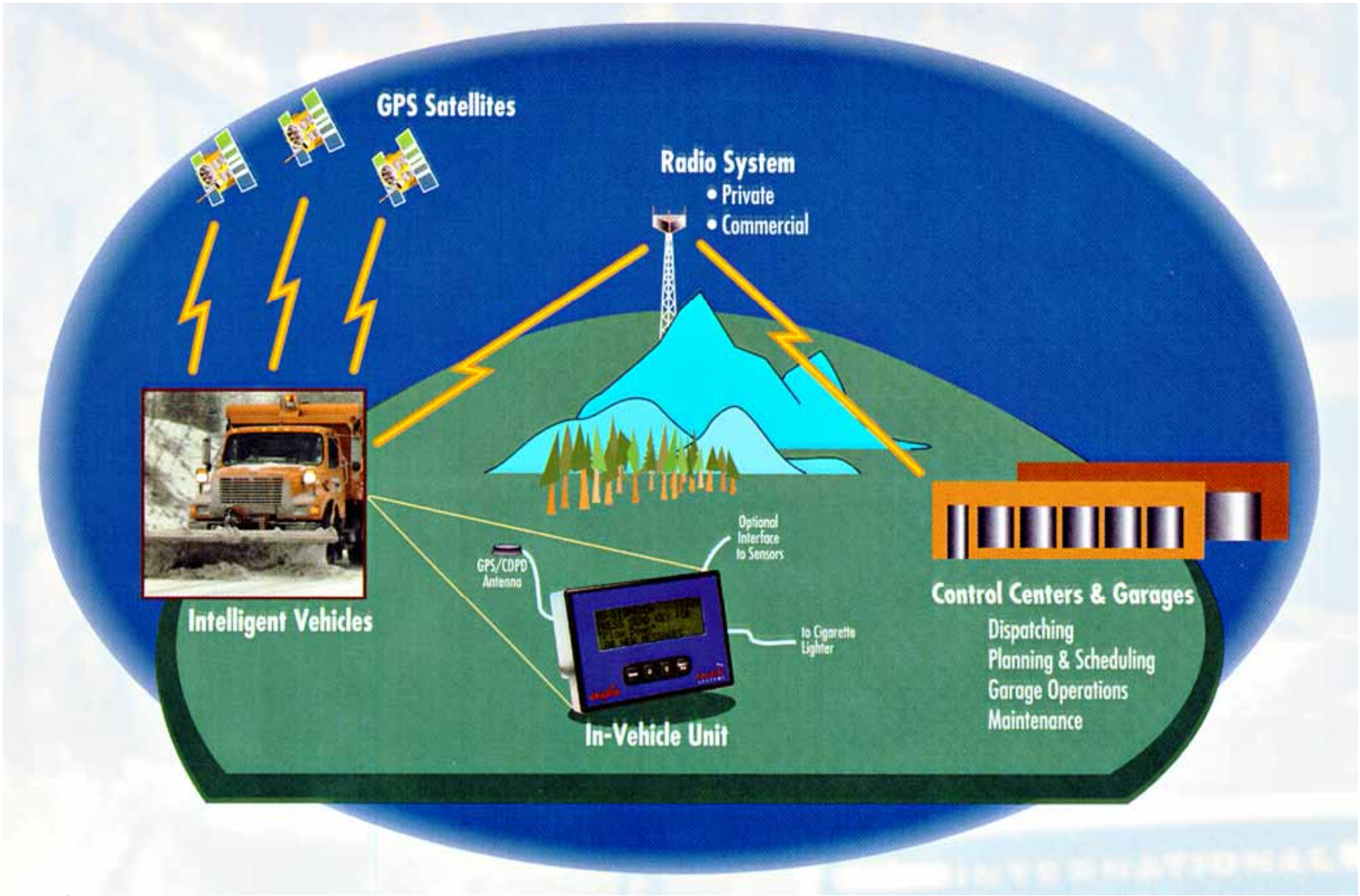


Example: FedEx Service Expansion



Example RFID Uses Today

- Vehicle identification
- Control access to
  - Parking Lots
  - Buildings
  - Corporate Campuses
- Tracking Library Books
- Buying goods – American ExpressPay
  - Pilot program at 350 fast food outlets and gas stations in Phoenix
  - Cut transaction times from average of 16.6 seconds with credit card to 8.6 seconds on RFID expresspay key fob
- Track assets in supply chain management


GPS Satellites
Radio System
• Private
• Commercial
Intelligent Vehicles
GPS/CDPD Antenna
Optional Interface to Sensors
to Cigarette Lighter
In-Vehicle Unit
Control Centers & Garages
Dispatching
Planning & Scheduling
Garage Operations
Maintenance

Questions

- What class of logistics and supply chain management problems can use real-time data for improved solution?
- How much can use of real-time data improve solutions in this class of problems?
- What must be done to optimally (or sub-optimally) extract the value (improved expected productivity, stability, resiliency) of real-time data?

Questions

What class of logistics and supply chain management problems can use real-time data for improved solution?

- Yes: sequential decision making under risk and uncertainty; e.g.,
  - Re-routing trucks in-route, based on real-time traffic information
  - Daily orders from PRC supplier to NA retailer, based on real-time position of in-route inventory and 'state' of port
- No: static deterministic decision making; e.g.,
  - Terminal geographic location determination

Comments & Research Challenges

- Models of sequential decision making under risk & uncertainty are fundamentally different from models of static, deterministic decision making. The following become important:
  - For each agent, who knows what and when? (information pattern)
  - Agent memory
  - Form of the data (knowledge representation)
  - Data sensor, transmission, and processing corruption & delay

Comments & Research Challenges

- Higher quality observations do not necessarily mean better systems performance; e.g., data have no value if not allowed to influence actions.
- Decentralized information patterns relatively unexplored.
- Use of natural language statements as data relatively unexplored.
- Substantial numerical challenges.