REPUBLIC POLYTECHNIC

E216 Distribution and Transportation

Problem 01

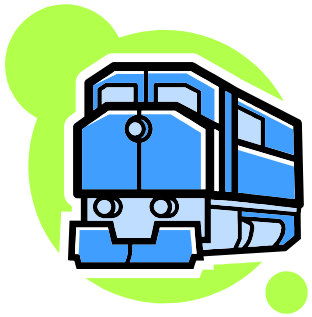
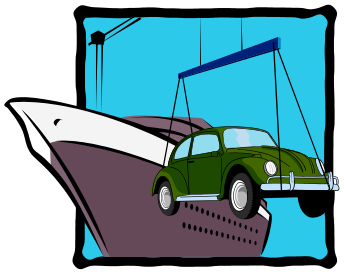
Which Transport

- Basic Modes of Transportation
- Types of Air and Ocean Carriers and its Characteristics
- Transportation Mode Selection

SCHOOL OF ENGINEERING

Basic Modes of Transportation

- There are 5 basic modes of transportation
  a) Rail
  b) Motor
  c) Water
  d) Pipeline
  e) Air

Mode of Transport – Rail

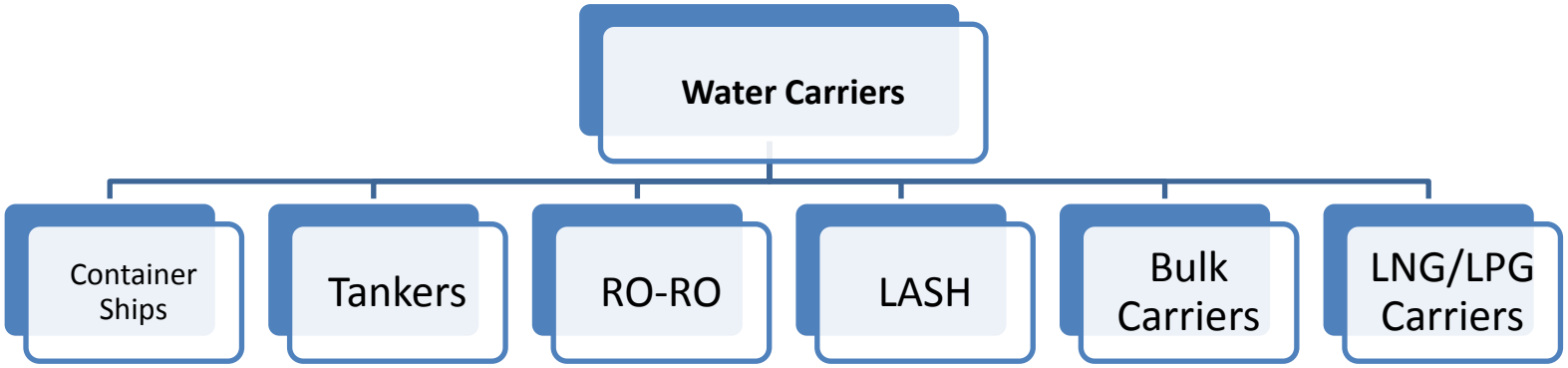
- Rail is a long haul, large volume system
  - High fixed costs; own rights-of-way.
- Capable of carrying a wide variety of products
  - E.g. Raw materials such as coal, lumber or low-valued manufactured products such as paper and wood products
- Reliability and safety are improving and are generally good.
- Accessibility can be a problem.
- Transit times are spotty and generally long

Mode of Transport – Motor Carriers

- Low cost of entry
  - Consists of for-hire and private carriers
- Characterized by low fixed costs and high variable costs.
- Do not own their rights-of-way.
- Limited operating authority regarding service areas, routes, rates and products carried.
- High accessibility; can offer door-to-door, speed and convenience
- Transit times faster than rail or water.
- Reliability can be affected greatly by weather.
- Relatively high cost compared to rail and water
  - More labor intensive
  - Trade-off is faster service

Mode of Transport – Water Carriers

- Relatively low cost mode; do not own rights-of-way; easy entry and exit.
- Typically a long distance mover of low value, bulk-type mineral, agricultural and forest products
- Low rates but long transit times
- Low accessibility
- Vessels can operate according to a fixed schedule, called liner vessels, or only when it is chartered (or hired) from the ship operator, thus called tramp vessels



Types of Water Carriers

- Container Ships
  - Specifically designed to carry 20 or 40 foot long containers
  - Containerization speed up the process of loading and unloading, minimizing idle time
  - measured according to number of 20 foot equivalent unit (TEUs)

- Tankers
  - Specially designed for liquid cargoes, e.g. crude oil and refined petroleum
  - Fitted with pumps and pipes to load and discharge liquid cargo

Types of Water Carriers

- RO-RO (Roll on-Roll off)
  - Basically a large ferry that facilitates the loading and unloading process by using drive on/off ramps
  - Designed to carry automobiles and heavy trucks as primary cargo

- LASH (Lighter Aboard Ship)
  - Designed to carry lighters (barges), where they are lifted by crane over the stern (rear) of the vessel

Types of Water Carriers

- Bulk carriers
  - Large compartments for carrying loads of ore, grain or coal
  - Entire ship is used for the same type of cargo

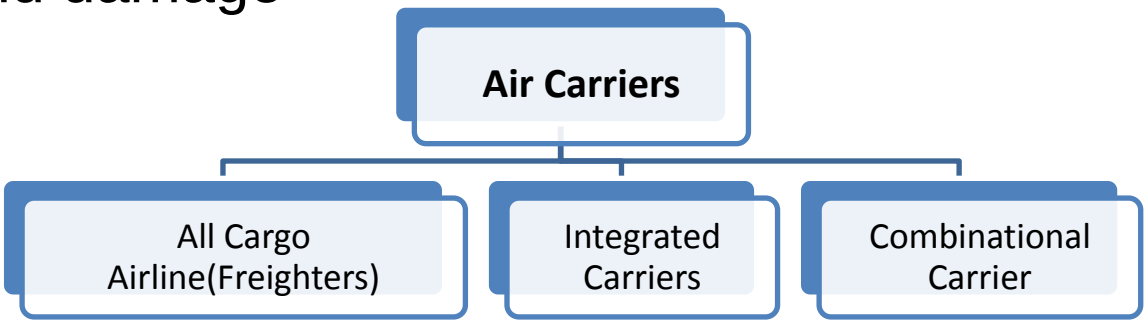
- LNG/ LPG carriers
  - Specially constructed to carry liquefied natural gas and liquefied petroleum gas in special pressurized tanks

Mode of Transport – Pipeline

- Limited range of services and capabilities, thus not suitable for general transportation
- Accessibility is very low
- Cost structure is highly fixed with low variable costs.
- Own rights-of-way much like the railroads.
- High dependability due to few interruptions to cause transit time variability
- High capacity and products are able to move 24/7

Mode of Transport – Air Carriers

- Constitutes the newest and the least used method of transporting cargo
- All air carriers can carry air freight but air freighters haul freight only
- Cost structure is highly variable; do not own rights-of-way
- Transit times are fastest but rates are also highest
  - Well-suited to carrying valuable, fragile and perishable cargoes
- Air-service dependability can be rated as good under normal operating conditions, and has a distinct advantage in terms of loss and damage



Types of Air Carriers

- All-Cargo Airline (Freighters)
  - ✓ Provide point-to-point service for air freight forwarders, either as common carriers or under guaranteed-space agreements
    - E.g. Polar Air Cargo, SIA Cargo, Lufthansa Cargo
  - ✓ Some others, like Atlas Air and Air Transport International, primarily operate aircraft on a contract basis for other airlines

Types of Air Carriers

- Integrated carriers (Express Carriers)
  - ✓ Operate door to door freight transportation networks that include own cargo aircraft, delivery vehicles, sorting hubs, and advance info systems to provide international delivery service

    E.g. FedEx, UPS, DHL

- Combination Carrier
  - ✓ Carries passengers and cargo
  - ✓ Primarily offers point-to-point services on wholesale basis
  - ✓ Relying on Freight Forwarders for pickups, delivery, sales to shippers and customer service

Transportation Desirability Criteria

	Cost	Speed	Reliability	Capability	Accessibility	Security
Rail	3	3	4	**5**	4	3
Road	2	4	**5**	4	**5**	4
Water	4	2	2	2	2	2
Air	**1**	**5**	3	3	3	**5**
Pipeline	**5**	--	--	**1**	--	--

1 = Least desirable 5= Most desirable

Source: *"Building Competitive Operations Planning and Logistics",* APICS , 2007, pp.2-166

Transportation Mode Selection

Transportation Mode Selection

- **Characteristics in Transportation Service Selection**
- **Basic Cost Trade-Offs**
- **Competitive Considerations**

Characteristics in Transportation Service Selection

Besides freight rate, other determinants are also important in the selection of transportation mode.

FIGURE 9–3 Importance Ranking of Carrier Selection Determinants

Determinant	Rank
Transit time reliability or consistency	1
Door-to-door transportation rates or costs	2
Total door-to-door transit time	3
Willingness of carrier to negotiate rate changes	4
Financial stability of the carrier	5
Equipment availabilit	6
Frequency of service	7
Pickup and delivery service	8
Freight loss and damage	9
Shipment expeditin g	10
Quality of operating personnel	11
Shipment tracing	12
Willingness of carrier to negotiate service changes	13
Scheduling flexibility	14
Line-haul services	15
Claims processing	16
Quality of carrier salesmanship	17
Special equipment	18

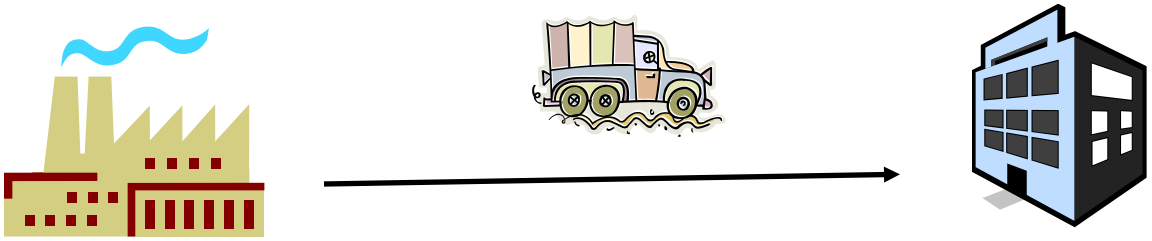
Source: Edward J. Bardi, Prabir Bagchi, and T. S. Raghurathan, "Motor Carrier Selection in a Deregulated Environment," *Transportation Journal* 29, no. 1 (Fall 1989): 4–11.

Basic Cost Trade-Offs

Steps:

- Find the transportation costs for each mode with in-transit inventory
- Find the In-transit inventory costs for each mode
- Sum both of the above to find the total cost
- Select the lowest total cost transport mode

Basic Cost Trade-Offs



Production Plant **Customer**

- The longer the door-to-door transit time, the higher the inventory cost in transit
- Annual cost of carrying this in-transit inventory is ***I*C*D*T/365***
  - I : Inventory Carrying cost of 1 unit
  - C : Value of one unit
  - D : Annual Demand
  - T : Time in Transit

Competitive Considerations

- Selection of transport mode may be used to create a competitive service advantage
- To Customer, a better transport service means lower inventory levels maintained and operating schedules met with greater certainty
- To Supplier, profits can be higher from the increase business, even from a more expensive transportation mode

Problem Statement

Method 1 - Basic Cost Trade-Offs

Mode	Rail	Sea	Truck	Air
Transportation Costs per kg ($R)	0.15	0.10	0.20	1.50
Door-to-Door Transit Time in days (T)	4	7	3	1
Calculation	**Rail**	**Sea**	**Truck**	**Air**
Transportation Costs ($) = R x D	75,000	50,000	100,000	750,000
In-Transit Inventory Costs = ICDT/365	2,055	3,596	1,541	514
Total Costs	77,055	53,596	101,541	750,514

- **Sea transport** offers the **lowest total cost** even though air transport offers the lowest In-Transit Inventory cost

Problem Statement

Method 2 – Competitive Considerations

Sample Calculation (Sea Mode):

Volume Sold for Sea Transport Mode (per month) = 50,000/2

= 25,000kg

Gross Profit on each kg = $2.50 x 30%

= $0.75

Total Gross Profit (per month)= $0.75 x 25,000 kg

= $18,750

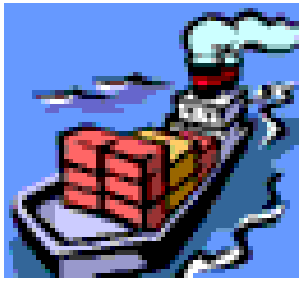
Transport Cost (per month) = Transport Rate x Volume in kg

= $0.10 x 25,000

= $2,500

Total Net Profit (per month) = $18,750 - $2,500

= **$16,250**



Problem Statement

Method 2 – Competitive Considerations

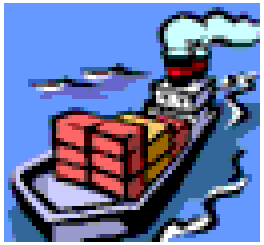
Mode	Rail	Sea	Truck	Air
Transportation Rate per kg ($R)	0.15	0.10	0.20	1.50
Lead Time in days (T)	4	7	3	1
Calculation				
If NT chooses...	**Rail**	**Sea**	**Truck**	**Air**
Volume sold in kg	25,750	25,000	26,000	26,500
Gross Profit	19,313	18,750	19,500	19,875
Transport Cost	3,863	2,500	5,200	39,750
Net Profit	15,450	16,250	14,300	(19,875)

Note: We assume that transport cost to be the only cost used in the computation of net profit

- Even though sea freight offers the lowest gross profit, it has the highest overall net profit

Problem Statement

- Based on Basic Cost Trade-Offs and Competitive Considerations, **sea freight** is selected as the best transportation mode
- In reality, other considerations like Characteristics in Transportation Service Selection & Transportation Desirability may also be taken, when more information is available



Learning Outcome

- Basic Modes of Transportation
- Types of Carriers and their Characteristics
- Transportation Mode Selection