Emerging Technologies and Economic Studies
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Outline

• Introduction
• Selected economic studies
• Decision support systems
• Emerging technologies
  – Radio frequency identification
  – Access control
Introduction
About Myself

• Graduated from Georgia Institute of Technology in 1999
  – Industrial and Systems Engineering
• Same year joined Mechanical and Industrial Engineering at the University of Illinois at Urbana-Champaign
• Last year sabbatical leave of absence at MIT
• Associate Professor in Civil and Environmental Engineering
Transportation Systems

• Interest
  – Airline management (Ph.D. thesis funded by United Airlines)
    • Sabre Holdings, American Airlines
  – Aviation and Logistics (FedEx Express)
  – Interplanetary logistics (NASA)
Deliverables

• Economic studies and guidelines
  – Financial consequences of a new policy, contract, regulation

• Decision support systems
  – Data analytics and optimization
  – Facilitate decision making
  – Planning or operational
Economic Studies
Airbus 380

- In 2007 O’Hare ready for A380
- Infrastructure
  - Runway/taxiway modifications
  - Size and passenger effect on terminals
- Benefits
  - Increased revenue
  - Decrease congestion
Airbus 380

• Additional revenue
  – Predict demand/price
  – Fees
  – Quantify additional revenue

• Will congestion really ease?
  – Implications to baggage handling
  – Gate congestion
  – Sit configuration
Boeing 787

• Does not require substantial changes to the infrastructure
• Study various demand scenarios
  – Effect on the airport
    • Moderate number of Dreamliners
    • Substantial usage of Dreamlinears
Customer Relationship

AIRPORT

TRAVELERS

AIRLINES
Fee Assessment

• Various fees
  – Terminal equipment
  – Terminal
  – Landing
  – Handling

• Mostly fixed amounts
Dynamic Pricing

• Common in several industries
  – Airline fares
  – Rental cars and hotels
  – Even retailers started using this concept

• Drivers
  – Squeeze every bit of revenue
  – As an incentive towards a goal
Dynamic Pricing

• Different fees at different time windows
  – Smoothen operations
  – Incentives mechanism
• Set towards targeted equipment types
• How to set the fee for a new equipment type
  – Airbus A380
  – Boeing Dreamliner
Customer Relationship

AIRPORT

TRAVELERS

AIRLINES
Queuing Analysis of Passengers

- Terminal areas have changed
  - Room for security processes
  - After August increased demand for drinks
  - Longer connection times

- Simulate and analyze
  - Level of service
  - Walking times
Customer Service

- Travelers spend more time at airports
- What should an airport provide?
  - Airlines provide clubs
- Improved customer experience
  - Fitness centers
  - Quiet reading rooms
  - Economics behind such services
Retail Space

- Retailers presence on the raise
  - Especially pronounced at European airports
- How to manage limited retail space
- Increase revenue for the airport
- Perform analysis
  - Evaluate revenue, cost
  - Leasing mechanism
Decision Support Systems
What are They?

- Computer based software
  - Data analytics
  - Recommend decisions
  - Perform cost/benefit analysis of alternatives/scenarios
  - Simulation
  - Visualization
Runway Constructions

• Runway renovations, additions
  – Timing effects airport capacity
  – Tightly connected with customers

• Strategic decision making
  – Sequence the projects
  – Schedule them
  – Can it be done without reducing capacity?
Runway Constructions

• Decision support system
  – Propose several scenarios
  – Effects on the airport and airlines
  – Risk assessment
  – Evaluate robustness
Aircraft Parking

• Manage efficiently overnight aircraft parking slots
  – Highly unpredictable
    • Some aircraft parked for days with little or no notice
    • Extremely dynamic environment
    • More aircraft than parking spots and gates
Aircraft Parking

• Decision support system
  – Establish database
  – Planning tool for where and how to park
  – Execution tool for day-to-day operations
    • Execution management
  – Provide cost analysis
  – Deviations from the plan
Robust Strategic Planning

• Long term sustainability in presence of uncertain future
  – Market forces
  – Economic cycles
  – Government
  – Technology

• Strategic plan
  – Capacity
  – Number of gates
  – Cargo requirements
Robust Strategic Planning

• Portfolio of strategic plans
  – Measures of effectiveness
  – Risk measures
  – Agile and adaptable plan
    • Robust and reliable
Emerging Technologies
RFID Primer

• Electronic barcode label
• Chip/tag instead of ‘paper label’
• Reader reads and writes to a tag
• Communication via radio waves
• Host computer linked to a database system communicates with a reader
RFID Primer
Key Benefits

• No need for line of sight
  – Communication via air
  – Not the case for barcode scanning

• Tracking at the item level
  – Each individual bag
  – Based on Electronic Product Code (EPC)
Access Control

• Efficient control of contractors’ access
  – Provide access by means of RFID enabled cards (smart cards)
  – A tracking system within the area
    • Embedded device (PDA, GPS)
    • Win-win scenario
      – Workers can be guided through the area
      – Provides tracking to the airport
  – Complete visibility
Baggage Tracking with RFID

- Already in place at some airports
- Benefits
  - Costly but prices of transponders are falling
    - Typically several different baggage handling systems in place
  - Enhanced security
  - Reduce the number of lost bags
    - Domestically 3.6 million of lost bags in 2005
Parking

• Wouldn’t it be nice that upon getting the parking ticket a few empty spots are recommended?
  – RFID/sensors are enabling technologies
  – Perform the cost/benefit analysis (ROI)
  – Real time visibility of inventory
Deliverables

• What would be the cost of an implementation
  – Compare alternatives
• What are the benefits for the airport
• Implementation time
Summary

• Computers and intelligent software
  – Much more can be done than a decade ago
  – New opportunities
    • It all comes down to profit and return on investment
    • Airport as an enterprise
  – Handling uncertain future