Overview of the Airline Planning Process

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M.Sc. Program

Network, Fleet and Schedule
Strategic Planning
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Lecture Outline

• Basic Airline Profit Model
  ▪ Fundamental Strategies to Improve Profitability

• Airline Planning Decisions
  ▪ Fleet Planning
  ▪ Route Evaluation
  ▪ Schedule Development
  ▪ Pricing and Revenue Management
  ▪ Operations Control

• Airline Organizational Structure
Basic Airline Profit Model

Operating Profit = Revenues - Operating Expense

Operating Profit = RPK x Yield - ASK x Unit Cost

• Use of individual terms in this profit equation to measure airline success can be misleading:
  ▪ High Yield is not desirable if ALF is too low; in general, Yield is a poor indicator of airline profitability
  ▪ Low Unit Cost is of little value if Revenues are weak
  ▪ Even ALF on its own tells us little about profitability, as high ALF could be the result of extremely low fares (yields)

• Profit maximizing strategy is to increase revenues, decrease costs, but the above terms are interrelated.
Strategies to Increase Revenues

• Increase Traffic Carried (RPKs):
  ▪ Reduce fares (average yields) to stimulate traffic, but revenue impact depends on demand elasticity
  ▪ For revenues to increase, price cut must generate disproportionate increase in total demand (i.e., “elastic demand”)
  ▪ Alternatively, frequency or service quality can be increased to attract passengers, but both actions also increase operating costs

• Increase Fares (Yields):
  ▪ Economic theory tells us any price increase will lead to an inevitable traffic decrease, but a price increase can still be revenue positive if demand is “inelastic” (i.e., percent decrease in passengers is lower than percent increase in price).
**Strategies to Reduce Costs**

- **Reduce Unit Costs (Cost per ASK):**
  - Reduce service quality, but too many cuts can affect consumers’ view of the airline’s product, leading to a reduced RPKs and market share
  - Increase ASKs by flying more flights and larger airplanes, which can lower unit costs but lead to higher total operating costs and lower load factors

- **Reduce Airline Output (Decrease ASKs):**
  - Cutting back on number of flights will reduce total operating costs, but lower frequencies lead to market share losses (lower RPKs)
  - Reduced frequencies and/or use of smaller aircraft can result in higher unit costs, as fixed costs are spread over fewer ASKs.
Airline Planning Decisions

1. **FLEET PLANNING**: What aircraft to acquire/retire, when and how many?

2. **ROUTE EVALUATION**: What network structure to operate and city-pairs to be served?

3. **SCHEDULE DEVELOPMENT**: How often, at what times and with which aircraft on each route?

4. **PRICING**: What products, fares and restrictions for each O-D market?

5. **REVENUE MANAGEMENT**: How many bookings to accept, by type of fare, to maximize revenue over the network?

6. **OPERATIONS CONTROL**: Implementing planned schedule of operations, given airport and air traffic control constraints.
Fleet Planning

Route Planning

Schedule Development
- Frequency Planning
- Timetable Development
- Fleet Assignment
- Aircraft Rotations

Pricing

Crew Scheduling

Revenue Management

Sales and Distribution

Airport Resource Management

Operations Control

SOURCE: Prof. C. Barnhart
1. FLEET PLANNING

• Fleet composition is long-term strategic decision and largest capital investment for an airline
  ▪ Affects financial position, operating costs, and especially the ability to serve specific routes.

• Economics of fleet choice
  ▪ Lower operating costs vs. higher ownership costs of new aircraft
  ▪ Lower trip costs of smaller aircraft vs. lower unit costs (CASK) and greater revenue generation of larger aircraft

• Fleet evaluations depend on aggregate analysis
  ▪ Detailed network profitability models seldom used given tremendous uncertainty of future demand, costs, competition
  ▪ “Top-down” economic and financial impacts evaluated with spreadsheets, NPV analysis and scenario-building
2. ROUTE EVALUATION

• Given a fleet, determination of routes to be flown
  ▪ Network structure (hub/spoke, point-to-point or hybrid)

• Evaluation approach at a disaggregate (route) level:
  ▪ Demand, market share and revenue forecasts required for specific route, perhaps for multiple years into the future
  ▪ Aircraft performance and operating cost characteristics

• Route planning decision factors
  ▪ Availability of aircraft with adequate range and capacity – link to fleet plan and overall network strategy
  ▪ Operational constraints and aircraft/crew rotation issues
  ▪ Regulations, bilaterals, and limited airport slots
  ▪ Opportunity cost of using aircraft on this route
  ▪ Degree of competition and expected competitive response
Example: Airline “Profit Manager”

1. Schedule Building
   - Host Airline and OAL Schedule
   - Connection Building Rules

2. Demand forecast
   - Market Share Model
   - Forecast Market Share by Itinerary

3. Traffic allocation
   - Market Sizes
   - Forecast Demand by Itinerary
   - Spill and Recapture Models
   - Estimate Traffic by Itinerary

4. Revenue and Cost Allocation
   - Revenues
   - Assign Revenues
   - Assign Costs
   - Direct Cost Allocation Rules

   Display Results
3. SCHEDULE DEVELOPMENT

- Involves several interrelated decisions, which to date have not been fully integrated:

  **Frequency Planning**: Number of departures to be offered on each route, non-stop versus multi-stop

  **Timetable Development**: Flight departure and arrival times, including connections at airline hubs

  **Fleet Assignment**: Aircraft type for each flight, based on demand and operating cost estimates

  **Aircraft Rotation Planning**: Links consecutive flights to ensure balanced aircraft flows on the network.
**Integrated Scheduling Planning Process: Key Decisions**

1. **Network Planning**
   - **Network Plan** 24-60 months
   - **Fleet Plan** 24-60 months

2. **Fleet Planning**
   - **Network Plan** 12-60 months
   - **Fleet Plan** adjustments

3. **Schedule Development**
   - **Schedule** 6-12 months
   - **New Fleet allocation**

4. **Schedule Revision**
   - **Fleet re-allocation between Bases**
   - **Schedule** 3-6 months

5. **Operational Plan** 0-12 months

- 60-24 months
- 24-12 months
- 12-6 months
- 6-3 months
- 3 months – 3 days
4. PRICING DECISIONS

• “Differential pricing” by airlines is universal:
  ▪ Different “fare products” within the coach cabin, with different restrictions, at different prices
  ▪ Virtually every airline in the world offers multiple price points (even low-fare carriers with “simplified” fare structures)

• “Pricing Decision Support Systems”
  ▪ Difficult to estimate price elasticity, willingness to pay, potential for stimulation and diversion
  ▪ No practical tools for airlines to determine “optimal” prices
  ▪ Primarily monitoring of competitive price changes

• Dominant practice is still to *match* low fares to fill planes and retain market share
  ▪ Need to match exacerbated by web sites and search engines
5. REVENUE MANAGEMENT

• Seat inventory control to maximize revenues
  ▪ Given a scheduled flight, capacity and prices, how many bookings to accept by fare type
  ▪ Objective is to maximize revenue -- fill each seat with highest possible revenue

• Computerized RM systems based on demand forecasting and revenue optimization:
  ▪ Leg-based RM systems increase revenues by 4-6%
  ▪ Network RM systems more sophisticated, add another 1-2%

• Recent industry developments affect RM systems
  ▪ Fare simplification and “fare family” bundling require new approaches to forecasting and optimization
  ▪ Alliance code-share traffic complicates both RM and distribution
## RM Strategy Affects Yield, Load Factor, Average Fare and Revenues

**EXAMPLE: 2100 MILE FLIGHT LEG**

**CAPACITY = 200**

<table>
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<th>FARE CLASS</th>
<th>AVERAGE REVENUE</th>
<th>YIELD EMPHASIS</th>
<th>LOAD FACTOR EMPHASIS</th>
<th>REVENUE EMPHASIS</th>
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<td>TOTAL PASSENGERS</td>
<td>110</td>
<td>160</td>
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<td>LOAD FACTOR</td>
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<td>AVERAGE FARE</td>
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<td>YIELD (CENTS/RPM)</td>
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6. OPERATIONS CONTROL

- Coordinate the daily operations of the airline on a dynamic basis.

- Ensure completion of schedule plan within company goals for on-time performance and safety.

- Process passengers, baggage and cargo subject to numerous operational constraints:
  - Limited number of gates, many with constraints on aircraft size
  - Airport flow limitations on taxiways and runways
  - Availability of airport and ground crew resources
  - Weather (both local and en route) as well as airport field conditions
  - Air traffic control (ATC) congestion and delays
Airline Planning and Operations

Network Planning

Revenue Management

Distribution CRS

Airline Ops Control
- Dispatch
- Maint
- Crew
- Station
- etc.

Aircraft

ATC

Passenger Processing

Flight Schedule

Seat Inventory (ASM)

Sched & Pricing

Reservations

Passengers

Payload:
- Passengers
- Baggage
- Cargo

Business Loop
- Controls RASM

Operational Loop
- Controls CASM

Travel Demand

Load Factor
- Yields
- RPMs
- RASM

Source: Prof. John Hansman
IT Systems: Planning and Distribution

CRS/GDS

- DISTRIBUTION FUNCTIONS
  SCHEDULES AND AVAILABILITY
- PRICING FUNCTIONS
  FARE QUOTES AND RULES
- SALES FUNCTIONS
  BOOKING AND TICKETING

AIRLINE “RES”

- FLIGHT RECORDS AND OPERATIONS DATA
- INVENTORY RECORDS
  SEAT AVAILABILITY
- FARES AND RULES
  DATABASE
- PNR DATABASE
- CUSTOMER DATABASE

AIRLINE PLANNING SYSTEMS

- SCHEDULE OPTIMIZATION
- CREW/AIRCRAFT PLANNING
- REVENUE MANAGEMENT
- PRICING DECISION SUPPORT

DEPARTURE CHECK-IN

FLIGHT DISPATCH

AIRLINE STAFF AT AIRPORT

TRAVEL AGENCY
Integrated Airline Planning Models

• Current practice is to perform scheduling, pricing and RM sequentially.

• Integrated models would *jointly* optimize schedules, capacity, prices, and seat inventories:
  ▪ Better feedback from pricing and RM systems can affect optimal choice of schedule and aircraft
  ▪ Better choice of schedule and capacity can reduce need for excessive discounting and “fare wars”

• Joint optimization and planning is a big challenge:
  ▪ Research is still required to identify models that can capture dynamics and competitive behaviors
  ▪ Organizational coordination within airlines and willingness to accept large-scale decision tool
Example: Airline Organizational Structure