Seminar: Air Cargo Supply Chain Management and Challenges

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Vice President
Air Cargo Solutions
Sabre Inc.

transporting air cargo into the future

Center for Intelligent Supply Networks (C4ISN)
Agenda

- Sabre, Inc. Overview
- Air Cargo Industry
- Air Cargo Landscape
- Cargo Revenue Management Concepts
- Cargo Revenue Management Solution
Sabre at a Glance

- Revenues of about $2 Billion
- A S&P 500 company
- NYSE symbol: TSG
- Headquarters in Dallas/Fort Worth, Texas
- Approximately 6,000 employees in 45 countries worldwide
Sabre Businesses

- Travel Marketing and Distribution
- Airline Solutions

Travelocity.com
A Sabre Company

GetThere
A Sabre Company
Airline Solutions

- 160 products & services clients
- 70 software products
- 70 reservations clients
- 42 consulting clients
- Diversified client list
The World of Sabre

North America
- US → AC → YV → ZV → QK
- CO → FL → F9 → EV → FH
- HP → DH → YX → ED → 7F
- NW → OH → PA → ZK → LI
- UA → QX → Q2 → AE → ED
- AA → AS → 5J → BW → QK
- DL → HA → XY → 7G → 2K
- NJ → SY → OQ → XJ → YX
- UP → TZ → JZ → NJ → 9X
- ZX → JI → NK → WO → 2Y
- DA → ZW → 9N → EO → JB
- WN → ED → 9X → VX → YJ
- HQ → AW → 2S

Central America
- AM
- MX
- CM
- LR
- TA
- VH
- JR
- RG

South America
- AV
- AR
- KK
- LB
- LV
- PL
- RG
- TR

Europe
- SK → SU → BY
- AZ → YW → BA
- IB → TP → EW
- AF → OS → LQ
- SR → IW → BD
- SN → LH → KL
- MK → SO → CY
- DI → AY → LT
- OA → 7U → K8
- TK → TU

Asia / Pacific
- TCZ
- GF → EK
- CX → MH
- NZ → PR
- CA → TG
- MU → NH
- TC → KE
- SQ → QF
- VT → OZ
- CI → BR

Middle East
- KU
- PK
- TK
- 9W
- AI
- MS
Airline Products and Services

**Pricing / Yield Management**
- AirMax
- AirPrice
- AirPrice Contract
- Composer
- Availability Processor
- Group Management System

**Finance Systems**
- TravelCard Pro

**Cargo**
- CargoMax
- CargoRev
- Cargo Claims
- CargoNet
- SabreCargo
- CargoPlan

**Crew Management**
- AirCrews
- BLGO
- CPOS
- CrewPlan
- CrewQual
- CrewTrac

**Planning / Scheduling**
- AirFlite
- Oasis
- ARM
- FAM
- TAM
- CRSSim
- DPM
- APM
- Slot Manager
- PC AirFlite

**Sales & Marketing**
- Traverse
- CRSView
- ProVision
- LiteVision
- WiseVision

**Flight Operations**
- FOS
- AirOps
- AirPath
- SteadyState
- FliteTrac
- Eagle
- M & E
- Maxi-Merlin
- RAPS

**Dining & Cabin Services**
- AirServ

**Customer Service**
- Qik-Access

**Airport**
- FliteSource
- Gate Plan
- GSE Plan
- StaffAdmin
- StaffManager
- StaffPlan
- GateManager

**Airline Products and Services**
Air Cargo Industry

transporting air cargo into the future
The international air cargo market is $40 billion a year and it is still the combination carriers that dominate.

Growth in air cargo anticipated to exceed passenger traffic growth in every major regional market.

Forecasts anticipate the addition of more than 2,600 freighter airplanes by 2019, as nearly 1,100 current freighters retire.

Customers around the globe are demanding better and faster products.

The air cargo industry has realized that information technology is key to meet their challenges.
Growth is projected at 6.4% per year during the next 20 years.
Asian cargo markets lead...
Major Traffic Flows

- A snapshot of international freight flows as a percentage of IATA international scheduled freight

Figure 2.5
Major Traffic Flows Between Regions in 2000
International Scheduled Freight Flows by Region as a percentage of IATA International Scheduled Freight

- North America: 2.1%
- Central America: 0.1%
- South America: 0.7%
- Europe: 9.1%
- Middle East: 0.8%
- Africa: 0.5%
- Asia: 13.6%
- SW Pacific: 0.4%
## Top 25 Freight Airlines

Table 3.3 Top 50 IATA Freight Airlines in 2000:
Scheduled Freight Tonne-Kilometres Flown (Millions), 1999 rankings shown in brackets.

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Air Cargo Landscape

transporting air cargo into the future
At a very high level…

- **Shipper/Forwarder**
  - **Shipper**
  - **Forwarder**
  - **Interline**
  - **Customers**

- **Airport/Airline Operations**
  - **Aircraft**
  - **Terminal**
  - **Customers**
  - **Interline**
  - **Consignee**
A bit more detailed…
The key players are...

- **Shipper**: Need a commodity sent anywhere in the world for the lowest cost and meet the required service level.

- **Forwarder**: Act as the “middle man” between the shipper and the airline.

- **Integrator**: Operate in business-to-business markets and specialize in door-to-door transport solutions.

- **Airline Operations**: Receive, store, transfer, track, load and unload cargo; assign and manage capacity; bill customers.

- **Consignee**: Recipient of the shipment.
Business challenges

Shipper
- Make bookings
- Negotiate best rates
- Preparation of Documents - Customs, Insurance
- Track shipments
- Accept billings and make payments
- Place claims and repair charges
- Speed (time sensitive)
- Reliability

Forwarder
- Make bookings
- Negotiate best rates
- Preparation of Documents - Customs, Insurance
- Track shipments
- Accept billings and make payments
- Place claims and repair charges
- Speed (time sensitive)
- Reliability
- Booking acceptance
- Bid for space – allotments
- Distribution
- Warehousing
- Invoice shipper
- Interact with multi-modal carriers
- Messaging and Transaction Ability
- Consolidation of Shipments
Business challenges

Airlines / Operations

- Schedule cargo flights
- Plan cargo routes
- Initialize and open flights for booking
- Negotiate rates
- Publish prices/rates
- Provide distribution channels
- Forecast cargo capacity
- Segment and forecast cargo demand
- Plan for no-shows, cancellations and Overbook
- Set-up Bid Prices
- Accept /Reject shipments
- Maximize Revenue
- Improve load factors
- Track shipments
- Accept Bids from customers
- Allocate Block Space - Allotments
- Resource Management of Terminal Staff
- Accept Shipments Tendered
- Dangerous Goods Control
- Package Validation
- Shipment prioritization
- Shipment re-accommodation
- Plan Loading of cargo - build, containerize etc.
- Unload Cargo
- Load balancing
- Warehousing
- Obtain/Send Flight Manifest
- ULD Management - Track, Inventory, Repairs etc.
- Service Reliability
- Plan for CAD
- Track and re-route Refusals
Business challenges

Airlines / Operations

- Offer Product Services
  - Express, Next Day
- Track shipments, containers
- Invoicing/Billing
- Prorating
- Interline billing
- Revenue Accounting
- Claims Management
- Receive/Send updates on arrival
- Receive/Send updates on delivery
- Message Interactions

Airports / Operations

- Warehousing - Storage
- Customs
- Security Clearance
- Dangerous Goods Control
- Package Validation
- Notify Captain
- Facilitate smooth cargo operations

Consignee

- Track shipments
- Accept billings and make payments
- Place claims and repair charges
Mapping of Business Challenges

Reliability
Negotiate Best Rates
Bid for Space – Allotments
Schedule cargo flights
Plan cargo routes
Initialize and open flights for booking
Negotiate rates
Publish prices/rates
Forecast cargo capacity
Segment and forecast cargo demand
Plan for no-shows, cancellations and Overbook
Set-up Bid Prices
Accept /Reject shipments

Maximize Revenue
Improve load factors
Accept Bids from customers
Allocate Block Space - Allotments

Revenue Management
Mapping of Business Challenges

Invoicing/Billing
Prorating
Interline billing
Revenue Accounting
Sales Accounting
Accept billings and make payments

Make bookings
Message Interactions
Shipment Tracking
Warehousing
ULD Management - Track, Inventory, Repairs etc.

Revenue Accounting

Reservations and inventory control
Mapping of Business Challenges

Terminal Operations

- Resource Management of Terminal Staff
- Load / Unload Cargo
- Staff Schedules
- Union Contracts
- Shipment Prioritization
- Receive Shipments

Container Management

- ULD Tracking
- ULD Control
- Distribution & Warehousing
Mapping of Business Challenges

Filing claims and repair charges
Claims processing
Claims tracking

Security Clearance
Embargo / Quarantine
Dangerous Goods control
Paperwork

Claims Management

Customs
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<tr>
<th>Airline Business Area</th>
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<td>Revenue Accounting</td>
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<td>Reservations &amp; Inventory Control</td>
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<td>CargoPlan, CargoNet</td>
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<td>Container Management</td>
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<td>Warehousing</td>
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<td><strong>Other Potential Business Areas</strong></td>
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<td>Solutions for Forwarders</td>
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<td>Solutions for multi-modal carriers</td>
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<tr>
<td>Auctions</td>
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<td>Solutions for Airline alliances (like WOW)</td>
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<tr>
<td>Solutions for Airline Forwarder alliances</td>
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<tr>
<td>Solutions for Integrators</td>
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<td></td>
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</table>
Cargo Revenue Management Concepts

transporting air cargo into the future
Revenue management is ..

- Integrated management of pricing and inventory
  - To maximize total revenue
    - By selling the right product (right price) to the right customer at the right time

- Key components are
  - Reduction of spoilage by selling more than available capacity
  - Match demand and supply (capacity) at network level
    - Considers routing possibilities
    - Long-haul displacing short-haul

- Key Requirements
  - Product/price differentiation exists
  - Demand exceeds supply
Revenue without and with price differentiation

- Revenue - $141,750
Passenger vs. Cargo Revenue Management

- Capacity is not known and not fixed
- Capacity is 2-dimensional
- Cargo can be over or under-tendered
- Limited number of customers
- Relationship based business
- Routing in most cases is flexible
- Demand is lumpy
- Sparse data and poor quality of data
- Less sophisticated users
- Reluctance to new methods
Revenue Management – Value proposition

- Improves revenue and profits (generally 2 to 7%)
  - Accuracy in capacity forecasts (consistent under forecasting) - translates to more space to carry cargo
  - Better overbooking decisions - more cargo booked to offset no-shows and cancellations
  - Optimal station/customer allotments - low value customers do not block valuable space
  - Better rate and density mix - maximize the use of all dimensions of capacity and protect space for high value cargo
- Reduces offloads and service failures
  - Accuracy in capacity forecasts (consistent over forecasting) - translates to less refusals
  - Better overbooking decisions - improved service reliability when showup is high
  - Ensuring operational feasibility through router module
Critical success factors

- Process fit - current processes and process gaps
- Organizational alignment – departments aligned to processes
- Technology fit - integrating revenue management system with existing systems
- Data availability - the major data requirements include post departure data, air waybill data, passenger bookings, and flight schedule
- User acceptance - acceptance and willingness from the user community
Cargo Revenue Management Solution

transporting air cargo into the future
Cargo revenue management - Functional Overview

- Medium to long-term allotment management
  - Optimal assignment of space to station/customers

- Short-term capacity and demand management
  - Capacity forecasting
  - Showup rate forecasting
  - Overbooking
  - Demand forecasting
  - Route generator
  - Bid pricing

- Reporting and proactive flight management tools
  - Management reports
  - Flight workbench (critical flights analyzer)
  - Performance monitoring
  - Customer valuation
Interaction among revenue management components

- Overbooking
- Show-up Rate Forecasting
- Route Generator
- Flight Manager
- Performance Monitoring
- Capacity Forecasting
- Bid Pricing
- Value Determination
- Cargo Capacities
- Bid Prices
- Space Allocations
- Values
- Allotment Management
- Demand Forecasting
- Performance Monitoring
- Management Reports
- Common Functionality
Modeling and Functionality

- Focuses on profitability as opposed to load factor
- Manages network capacity instead of leg capacity
- Focuses on freight mix based on density and revenue
- Controls are based on commercial feasibility and operational feasibility
- Capacity segmentation is in terms of time horizon and products
- Allows the capability use ‘bonus’ or ‘value’ based on O&D and customer.
System Setup

- Control values are set several days before departure and then updated nightly until departure
- Control values are in terms of weight, volume, and positions
- Users have the ability to set default values and overrides
- Monitors performance of forecasts and user overrides
Approach to Forecasting

transporting air cargo into the future
Approach to Forecasting

- Capacity, showup rate, and demand forecasts are key inputs
- Forecasting is based on historical and current data
- Forecasts are monitored on a regular basis
Cargo Capacity

- PAX Weight
- PAX Bag Weight
- Mail Weight
- Other Weight
- Extra Fuel Weight
- Allotments
- Freesale

Payload

- Total Cargo Capacity
- Allotments
- Freesale

- PAX Bag Volume
- Mail Volume
- Other Volume
- Allotments
- Freesale

Total Cargo Capacity

- Belly Volume
- Payload
Capacity Forecasting

- A tool for forecasting the capacity available for cargo by flight leg and departure date
- Forecasts flight capacities in terms of weight, volume, and positions
- Interfaces with Passenger Revenue Management system to obtain expected passengers on board
Capacity Forecasting

- Bag Standards
- Stacking Loss
- Mail Forecast
- Passenger Forecast
- Fuel Weight
- Positions
- Payload Forecast
- Capacity Forecasts by flight leg and departure date
- Payload Forecast
- Fuel Weight
- Mail Forecast
- Stacking Loss
- Bag Standards
Showup Rate Forecasting

- A tool for forecasting the booking behavior of flights by flight leg and departure date
- Considers no-shows, cancellations, and over/under tendering.
- Forecasts showup rates in terms of weight, volume, and positions
Showup Rate Forecasting

Historical Tender

Historical Booking

Showup Forecasting Model

Showup forecasts by flight leg and departure date
Demand Forecasting

- To properly manage cargo profitability, forecasting needs to be done by demand groups or ‘rate classes’
- A rate class should have shipments that are very similar in density and revenue - to address density mix and rate mix
- Key data requirements include historical bookings and current bookings
Rate/Density Clustering (Rate Class)
Rate/Density Clustering (Rate Class)

Remaining demand by Rate-Density class

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</tr>
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<tr>
<td>46.00</td>
<td>240</td>
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</tbody>
</table>
Demand Forecasting

Demand Group Definition

Demand Grouping

Historical Booking

Current Booking

Forecasting Model Parameters

Demand Forecasting

Demand Forecasts
Methodology for Optimization

transporting air cargo into the future
Methodology for Optimization

- Capacity segmentation by time - allotment optimization for medium term customer/station allotments
- Overbooking of remaining space to account for booking behavior
- Generate routing options to carry cargo
- Match O&D demand to leg capacities considering routing options and rate/density classes
  - Compute bid prices
  - Determine capacity allocations
Allotment Management

- A tool for managing medium term station or customer agreements
- Contains a network based optimization model that evaluates competing requests based on:
  - Promised revenue
  - Historical utilization
  - Flight schedule
  - Available capacity for allotments
  - A pre-defined set of business rules
- The model generates a business-practical solution that maximizes the revenue for the airline
Allotment Management

- Schedule
- Available Capacity
- Container Data
- Allocation Rules

Allotment Requests -> Allotment Management Model

Recommended Allotments -> Allotment Usage Model

Allotment Requests

- Available Capacity
- Container Data
- Allocation Rules

Allotment Management

Recommended Allotments
Overbooking

- Overbooking offsets the effect of cancellations, no-shows, and over/under-tendering
- Based on booking behavior, economic aspects (maximize net revenue or minimize sum of offload and spoilage costs), and acceptable level of service failure
- Users can set the maximum acceptable service failures at flight, entity, or system level
- Users have the ability to override the authorized capacities for specific flight departures
Spoilage and Offload Costs

- Spoilage Costs
- Offload Costs
- Overbooking Level
- Total Cost

Cost vs. Overbooking Level graph.
Overbooking

Show-up Rate Model

- Flown Air waybills
- Booking Records

Overbooking Model

- Costs and Overrides
- Acceptable Service Failure
- Capacity Forecasts

Authorized Capacity
Routing

- Generates routes for the bid price model within the Revenue Management Module
- Determines feasible routes at the time of processing a booking request
  - Takes into account operational requirements
  - Accounts for shipment characteristics
  - Ensures that the selected routes meet the service level
  - Considers cost, time, and distance
- Handles the complexity of multi-hub network
Routing

Schedule
Via/Not Via
Connect Times
Service Level
Shipment Characteristics

Shortest Path Model

Route Costs and Times
Routes

Schedule
Via/Not Via
Connect Times
Service Level
Shipment Characteristics

Shortest Path Model

Route Costs and Times
Routes
Bid Pricing / Allocation

- Is an O/D based network optimization model that maximizes network profitability
- Matches demand to capacity over multiple routes by redirecting cargo from high to low-load factor flights
- Leg bid price for a flight leg is \((\text{wt BP} + \text{Vol BP/density})\)
- O and D bid price is the sum of the bid prices of flight legs along the route of the shipment
- Bid price gradients enable bid prices to be adjusted to reflect capacity changes
Bid Price Example

Capacity = 15 tons
Bid Price = $1.00/kg

Capacity = 25 tons
Bid Price = $0.50/kg
Bid Price

Network Based Bid Price Model

- Schedule
- Authorized Capacity
- Demand Forecasts
- Connection Matrix
- Revenue and Cost

Bid Prices
- Space allocation to Demand Group

Authorized Capacity
Demand Forecasts
Connection Matrix
Revenue and Cost

Space allocation to Demand Group
Bid Prices
Customer Valuation

- A tool for assigning relative importance to major customers
- Customer value is used to scale up or scale down the offered rate when making booking acceptance decisions
- Customer value may vary by segment and season
- Customer value can be based on several variables: total revenue, space utilization, commodity shipped, claims history, etc.
Customer Valuation

User Preferences

- Sales
- Operations
- Revenue Management
- Finance

Value Determination Model

Customer values
Major categories of data

- Flight Schedule
- Booked and tendered cargo information
  - Advance and live air waybills
- Pre and post departure flight information
  - Mail, bags, passengers, cargo, payload, fuel, etc.
- Expected passengers on board
- Reference data
  - Aircraft, container, station, customer, commodity, products, etc.
- Historical data
Key interfaces

Cargo Reservation System
- Bid Price/Allocations
- Booking Requests and other updates

Cargo RMS
- Flown Air Waybills
- Post-departure data
- Flown Air Waybills

Cargo Revenue Accounting
- Passenger Booking

Flight Operations/Departure Control

Passenger Revenue Management

DB Tables/User Inputs

Legend:
- Real-time link
- Batch Process
- Batch/real-time
Further research is needed …

- Overbooking model
  - Show up rate distribution
  - 2-dimensionality
  - Shipment level overbooking

- Demand forecasting
  - Stability/accuracy of forecasts - Lumpy demand, multiple rate classes, fewer booking requests
  - Predicting when to use and when not to use forecasts
  - Estimating true demand: demand reduction/un-truncation

- Integrated overbooking and bid pricing