Air Transport Management Course: Universidade Lusofona

Air Cargo Economics

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January 2008
Air Cargo Economics - Outline

- Air cargo participants
- Air cargo pricing, rates & yields
- Cargo related costs
- Freighter aircraft operating costs
- Methods of cost allocation
- Pax/combi vs freighter services
- Lufthansa’s cargo strategy
- Quick change aircraft
- Aircraft wet leasing
- Conclusions
Which participants?

- **Airlines** (*airport to airport*)
- **Forwarders** (*airport delivery & collection*)
- **Consolidators** (*airport delivery & collection*)
- ** Integrators** (*door to door*)
- **Commercialised postal services** (eg Dutch and German - *door to door*)
Which airlines?

- **Air cargo subsidiaries**
  
  *eg Lufthansa, SAS and Singapore Airlines*

- **Major freight airlines (cargo revenues > 20% of total)**
  
  *eg Air France-KLM, Korean and Cathay*

- **Passenger focused airlines (cargo revenues < 10% of total)**
  
  *eg BA, American, Aer Lingus*

- **Passenger airlines that carry no air cargo**
  
  *eg Many low-cost airlines*
Major areas of concern

1. Declining yields (31%)
2. Over-regulation (25%)
3. Security (14%)
4. Over-capacity (11%)

Source: TIACA survey of 500 air cargo executives worldwide (2002)
Air Cargo Rates: Combination Carriers

- General commodity rates (incentive for heavier shipments through weight breaks)
- Specific commodity rates (originally designed to attract certain types of shipment)
- ULD/Container rates (for shipper or forwarder packed ULDs)
- Class rates (requiring special handling)
- FAK rates (freight all kinds – low rates based on minimum weight break-points)
- Contract rates (for specific clients meeting minimum annual or weekly volumes)
- Premium product rates (eg td-flash, td-x)
London - Tokyo Cargo Rates (April 2001)

<table>
<thead>
<tr>
<th>Rate Classification</th>
<th>Min. Kgs</th>
<th>£ per Kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td></td>
<td>8.20</td>
</tr>
<tr>
<td>Q (NP)</td>
<td>5</td>
<td>4.99</td>
</tr>
<tr>
<td>Q (BG)</td>
<td>10</td>
<td>4.96</td>
</tr>
<tr>
<td>Q</td>
<td>100</td>
<td>6.52</td>
</tr>
<tr>
<td>Q</td>
<td>300</td>
<td>5.27</td>
</tr>
<tr>
<td>Q</td>
<td>500</td>
<td>4.49</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>2.42</td>
</tr>
<tr>
<td>386</td>
<td></td>
<td>3.73</td>
</tr>
<tr>
<td>1024</td>
<td>100</td>
<td>3.54</td>
</tr>
<tr>
<td>4402</td>
<td>100</td>
<td>4.24</td>
</tr>
<tr>
<td>6002</td>
<td>100</td>
<td>4.58</td>
</tr>
<tr>
<td>7119</td>
<td>250</td>
<td>2.42</td>
</tr>
<tr>
<td>8277</td>
<td>250</td>
<td>2.42</td>
</tr>
</tbody>
</table>
Lufthansa fuel price surcharges

Fuel price index: 100 = 53.35 US cents per US gallon
Fuel price average of five most important markets
Fuel price index (3 June 2005): 291

Fuel surcharge = 0 for fuel price index of 100, then for example:
Fuel price index exceeds 240 for a period of two consecutive weeks:
Fuel surcharge adjusted to €0.30 per kg
Fuel price index exceeds 265 for a period of two consecutive weeks:
Fuel surcharge adjusted to €0.35 per kg
Fuel price index exceeds 290 for a period of two consecutive weeks:
Fuel surcharge adjusted to €0.40 per kg

Two weeks’ notice for all changes
Pricing: volume conversion

Aircraft tend to ‘cube out’ rather than ‘weigh out’
B747-400 has only 70 cu.m. available for cargo in lower deck, but 20 tonnes (3.5 cu.m per tonne)
Low density shipments converted to chargeable weight using 6 cu.m/tonne (IATA proposed reducing this to 5 cu.m per tonne from 1/10/03, but withdrew this in March 2005)
Shippers and forwarders need to take care using voluminous packaging materials
Change reflects change in shipments from heavy machinery to DVDs, CDs, fresh produce
Change also reflects less lower deck space available for cargo in latest versions of B747 (more passengers and range/fuel)
## Consolidation and rates

<table>
<thead>
<tr>
<th></th>
<th>Pieces</th>
<th>Volume (cu.metres)</th>
<th>Actual weight (kg)</th>
<th>Chargeable weight (kg)</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pillows</td>
<td>1,000</td>
<td>12</td>
<td>227</td>
<td>2,004</td>
<td>1,804</td>
</tr>
<tr>
<td>Crane parts</td>
<td>3</td>
<td>2</td>
<td>2,268</td>
<td>2,268</td>
<td>2,041</td>
</tr>
<tr>
<td><strong>Consolidated</strong></td>
<td>1,001</td>
<td>14</td>
<td>2,495</td>
<td>2,495</td>
<td>2,246</td>
</tr>
<tr>
<td>kg per cu.m</td>
<td>167</td>
<td>or 6 cu.m per tonne</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate: $/kg</td>
<td>0.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Consolidator pays airline $2,246; Shippers could pay consolidator $1,804 + $2,041 = $3,845 ($4,175 under proposed conversion)
Rate Examples: London/New York

- **TNT (Door to door):**
  - Global Express (10kg) £122
  - Global Express priority (10kg) £147

- **IATA Airlines (airport to airport):**
  - General cargo rates: Minimum charge - £50
  - Standard rate £4.03 per kg
  - Consignment > 100kg £2.15 per kg
  - Consignment > 300kg £1.34 per kg
  - Consignment > 500kg £1.24 per kg
  - ULD rate £0.95 per kg
AEA scheduled service yields (current price US$)

Av.% decline 1991-2005: 1.4% pa cargo & 0.9% pa pax
(US CPI +2.5% pa)
AEA North Atlantic air cargo yields vs exchange rates

Source: IMF and AEA
Costs of Freighter Aircraft

- Fuel
- Aircraft Rental
- Maintenance & Overhaul
- Crew Salaries & Expenses
- Airport & Navigation
- Handling & Parking
- Advertising & Promotion
- General & Administrative
## Fuel share of aircraft operating costs, 2006

<table>
<thead>
<tr>
<th>Aircraft Type</th>
<th>Fuel Price (US$/gal)</th>
<th>Fuel %</th>
</tr>
</thead>
<tbody>
<tr>
<td>B747-400 (Atlas)</td>
<td>2.15</td>
<td>64</td>
</tr>
<tr>
<td>B747-2/300 (Atlas)</td>
<td>2.15</td>
<td>62</td>
</tr>
<tr>
<td>B747-400 (NW)</td>
<td>2.08</td>
<td>61</td>
</tr>
<tr>
<td>MD-11 (UPS)</td>
<td>2.14</td>
<td>58</td>
</tr>
<tr>
<td>MD-11 (Gemini)</td>
<td>2.15</td>
<td>54</td>
</tr>
<tr>
<td>B747-1/200 (UPS)</td>
<td>2.14</td>
<td>51</td>
</tr>
<tr>
<td>DC-10 (FedEx)</td>
<td>1.93</td>
<td>40</td>
</tr>
<tr>
<td>MD-11 (FedEx)</td>
<td>1.94</td>
<td>36</td>
</tr>
</tbody>
</table>

Source: US Form 41 in the Airline Monitor
## Freightier Fuel Efficiency (US$2.15/gallon)
(Derived from US Form 41 data - 2006)

<table>
<thead>
<tr>
<th>Aircraft type</th>
<th>Max. capacity (tonnes)</th>
<th>Fuel US$ per block hour</th>
<th>Fuel US cents per ATM</th>
</tr>
</thead>
<tbody>
<tr>
<td>A310-200F</td>
<td>38</td>
<td>1,561</td>
<td>23.0</td>
</tr>
<tr>
<td>A300F</td>
<td>45</td>
<td>3,256</td>
<td>19.8</td>
</tr>
<tr>
<td>DC10-30F</td>
<td>76</td>
<td>2,233</td>
<td>18.0</td>
</tr>
<tr>
<td>MD-11F</td>
<td>88</td>
<td>2,465</td>
<td>12.3</td>
</tr>
<tr>
<td>B747-200F</td>
<td>112</td>
<td>3,571</td>
<td>15.5</td>
</tr>
<tr>
<td>B747-400F</td>
<td>112</td>
<td>2,905</td>
<td>12.1</td>
</tr>
</tbody>
</table>
## Impact of higher fuel prices on freighters

<table>
<thead>
<tr>
<th></th>
<th>MD-11F</th>
<th>B747-200F</th>
<th>B747-400F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel price (cents/gallon)</td>
<td>0.70</td>
<td>0.70</td>
<td>0.70</td>
</tr>
<tr>
<td>US gallons per hour</td>
<td>2,465</td>
<td>3,571</td>
<td>2,905</td>
</tr>
<tr>
<td>LHR/HKG gallons consumed</td>
<td>27,115</td>
<td>39,281</td>
<td>31,955</td>
</tr>
<tr>
<td>Trip fuel cost (US$)</td>
<td>18,981</td>
<td>27,497</td>
<td>22,369</td>
</tr>
<tr>
<td>Difference vs MD11F (US$)</td>
<td>-</td>
<td>8,516</td>
<td>3,388</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>MD-11</th>
<th>B747-200</th>
<th>B747-400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel price (cents/gallon)</td>
<td>2.20</td>
<td>2.20</td>
<td>2.20</td>
</tr>
<tr>
<td>US gallons per hour</td>
<td>2,465</td>
<td>3,571</td>
<td>2,905</td>
</tr>
<tr>
<td>LHR/HKG gallons consumed</td>
<td>27,115</td>
<td>39,281</td>
<td>31,955</td>
</tr>
<tr>
<td>Trip fuel cost (US$)</td>
<td>59,653</td>
<td>86,418</td>
<td>70,301</td>
</tr>
<tr>
<td>Difference vs MD11F (US$)</td>
<td>-</td>
<td>26,765</td>
<td>10,648</td>
</tr>
</tbody>
</table>

+ 24 tonnes
Freighter vs passenger aircraft utilisation: B747*

Source: AEA 2003 Summary of traffic and airline results
## Long-haul Freighter Aircraft Operating Costs: 2006

(Source: DOT Form 41; fuel @ US$2.15/gal)

<table>
<thead>
<tr>
<th></th>
<th>B747-400F</th>
<th>MD-11F</th>
<th>Percent Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trip distance (km)</td>
<td>5,482</td>
<td>4,875</td>
<td></td>
</tr>
<tr>
<td>Available payload (tonnes)</td>
<td>113</td>
<td>90</td>
<td>25.0</td>
</tr>
<tr>
<td>Block time (hrs)</td>
<td>6.8</td>
<td>6.4</td>
<td></td>
</tr>
<tr>
<td>Block fuel (US gals)</td>
<td>21,512</td>
<td>15,337</td>
<td></td>
</tr>
<tr>
<td>Annual trips</td>
<td>9,068</td>
<td>11,280</td>
<td></td>
</tr>
<tr>
<td>Annual block hours</td>
<td>61,810</td>
<td>72,298</td>
<td></td>
</tr>
</tbody>
</table>

### Operating costs:

<table>
<thead>
<tr>
<th></th>
<th>B747-400F</th>
<th>MD-11F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flight crew</td>
<td>7,963</td>
<td>7,420</td>
</tr>
<tr>
<td>Fuel</td>
<td>46,250</td>
<td>32,974</td>
</tr>
<tr>
<td>Aircraft dry lease</td>
<td>6,060</td>
<td>21</td>
</tr>
<tr>
<td>Maintenance</td>
<td>8,056</td>
<td>5,569</td>
</tr>
<tr>
<td>Depreciation</td>
<td>2,165</td>
<td>7,222</td>
</tr>
<tr>
<td>Other costs</td>
<td>209</td>
<td>704</td>
</tr>
<tr>
<td>Total trip costs (US$)</td>
<td>70,703</td>
<td>53,910</td>
</tr>
<tr>
<td>Total per block hour ($)</td>
<td>10,373</td>
<td>8,411</td>
</tr>
<tr>
<td>Total per ATK (cents)</td>
<td>11.42</td>
<td>12.24</td>
</tr>
</tbody>
</table>
## Freighter lease rates (2003)

<table>
<thead>
<tr>
<th>Aircraft</th>
<th>Year built</th>
<th>per month rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>A300F4</td>
<td>1980-84</td>
<td>$125-165,000</td>
</tr>
<tr>
<td>B757SF</td>
<td>1994-98</td>
<td>$185-235,000</td>
</tr>
<tr>
<td>DC10-30</td>
<td>1979-84</td>
<td>$125-185,000</td>
</tr>
<tr>
<td>MD-11</td>
<td>1994-99</td>
<td>$450-545,000</td>
</tr>
<tr>
<td>B747-200</td>
<td>1979-84</td>
<td>$130-220,000</td>
</tr>
<tr>
<td>B747-400</td>
<td>1993-03</td>
<td>$490-1,150,000</td>
</tr>
</tbody>
</table>

*Rates firmer in June 2007: ie B747-400F: $1.0m to $1.4m a month*
Cargo cost allocation methods

- **By-product (revenue offset)**
  - Cargo break-even
  - Incremental cargo cost

- **Joint product (fully allocated costs)**
  - Weight, volume, zone, revenue, profit contribution
  - or equivalent freighter methods

- **Other (no cost allocation)**
  - Profit proportional to revenue
Joint Passenger/Cargo Air Services

**Cargo specific/related costs:**
- Handling (loading/unloading/transshipment)
- Sales, promotion and commissions
- Cargo insurance and other
- Additional fuel (due to cargo payload)

**Passenger specific/related costs:**
- Handling (check-in, baggage, ramp, lounges)
- Cabin crew and in-flight catering
- Airport passenger departure fees
- Sales, ticketing, promotion and commissions
- Pax insurance and other
- Additional fuel (due to pax/bags payload)
Joint Passenger/Cargo Air Services: Joint costs to be allocated to products

- Aircraft capital costs
  Depreciation, lease rentals, interest
- Aircraft insurance
- Basic fuel (without payload)
- Aircraft maintenance and overhaul
- Cockpit crew
- Landing fees
- Air navigation charges
Cargo breakeven for 747-300
6 pallet combi (by-product)

Revenue = $75,900

Pax profit = $10,000

Total Pax cost = $65,900 - 23,700

$52,200

$10,000

$20,400

Joint costs

Total cargo cost = $23,700

$23,700

$35,200

$10,300

Cargo related costs

Cost = $65,900
Volume allocation for 747-300
6 pallet combi (joint product)

Effective volume of passenger cabin:
360 pax @ 36.1 cu.ft/pax = 12,996 cu.ft (65.4%)

Cargo cabin volume:
6 pallets + lower deck (ex pax bags) = 6,867 cu.ft (34.6%)

Total volume 19,863 cu.ft (100.0%)

Costs allocated to pax (65.4% x $35,200) = $23,000
Costs allocated to cargo (34.6% x $35,200) = $12,200

Pax profit = $52,200 – 20,400 – 23,000 = $8,800
Cargo profit = $23,700 – 10,300 – 12,200 = $1,200
Weight allocation for 747-300
6 pallet combi (joint product)

Weight payload of passenger cabin:
360 pax @ 100 kg/pax = 36,000 kg (53.5%)

Cargo main and lower deck weight payload:
6,867 cu.ft x density of 4.56 kg/cu.ft = 31,314 kg (46.5%)

Total weight 67,314 kg (100.0%)

Costs allocated to pax (53.5% x $35,200) = $18,832
Costs allocated to cargo (46.5% x $35,200) = $16,368

Pax profit = $52,200 – 20,400 – 18,832 = $12,968
Cargo profit = $23,700 – 10,300 – 16,368 = ($2,968)
Profit Comparison: Allocation Methods for 747-300 Combi Example

Cargo breakeven | Volume allocation | Weight allocation | Equivalent freighter | Profit contribution | Profit proportional to revenue

-$2,968 | $1,200 | $10,000 | $8,800 | $7,400 | $7,000 | $6,900

$12,968 | $2,600 | $7,000 | $3,000 | $3,100 |
IATA Airlines Air Cargo Financial Performance

Source: IATA Airline Economic Results & Prospects
Airline air cargo financial results

Source: AT1 and airline annual reports
Lufthansa’s Separate Cargo Corporation

- Global Cargo Net
- Global Cargo Handling Services
- Global Freighter Operations

*Own planning and investment decisions*
*Greater cost and profit transparency*
*Better customer focus*
*But lose some economies of scale and need to negotiate rates for lower deck capacity with passenger business*

*Other WOW members follow, but JAL decides against*
Quick Change Aircraft

- In Europe, passenger flights by day and cargo flights by night (Lufthansa/Deutsche Post and Aeropostale using B737-300)
- In USA, cargo flights during the week and passenger charters at week-ends (UPS using 113 seat B727 – to be discontinued end 2001)
Freighter Wet Leasing (1)

- Wet leasing of freighters from specialists such as Atlas Air (eg BA)
- Significant advantages for those airlines who could only justify small freighter fleet
- Allowed under EU Regulation 2407/92 only for ‘short-term’ or ‘exceptional needs
- Atlas formed UK company with 51% UK shareholding to get round restriction
Freighter Wet Leasing (2)

- Forwarders and consolidators can also operate their own freighters on higher density routes:
  
  *Danzas on Hahn to Charlotte in US using A300F leased from Turkish carrier, MNG*
  
  *Panalpina on a number of routes using Cargolux (all part of Swissair group)*
  
  *EGL from Austin, Texas, to Taipei using Gemini DC10-30F*
Conclusions

✓ Cargo makes valuable contribution to passenger service economics, especially on long-haul flights

✓ Diversion of high yield cargo to integrators

✓ Cargo yields much lower than pax yields, but unit costs much lower; similar trends

✓ Fuel surcharges and exchange rates important in yield trends

✓ Cost allocation and pricing more complex than for passenger operations

✓ Aircraft utilisation (for new aircraft) and load factors for both directions crucial