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Leipzig Case Study

Development of a European Integrator Hub

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AGENDA

- Modeling approach and assumptions

KEY ASSUMPTIONS

Description

Commercial

- Markets ranked according to potential and clustered into business centers, major locations and regional destinations
- Three early-AM service levels defined and linked to markets:
  - Business centers: 09:00
  - Major locations: 12:00
  - Regional destinations: 15:00
- Low yield product treated as filler only

Network and fleet structure

- 1-hub Leipzig-based network
- Jet fleet mix (A-300, B-757, B-737 and ‘standardized’ feeders (Fokker 50, ATR42, EM120)
- Operational and cost assumptions supplied by case study document (net capacities, turnaround times, block times, range curves, fixed/variable costs)
- Minimum connect times depending on mode and aircraft type connectivity

Operational

- Hub:
  - 2-hour hub sort window
  - Maximum of 36 flight movements per hour

SERVICE LEVELS WERE DEFINED AND LINKED TO MARKETS

Market definitions

‘Business centers’	Top markets in Europe with an area GDP above EUR 27 billion
‘Major locations’	Next markets with an area GDP between EUR 14-27 billion
‘Regional destinations’	All other markets with an area GDP below EUR 14 billion

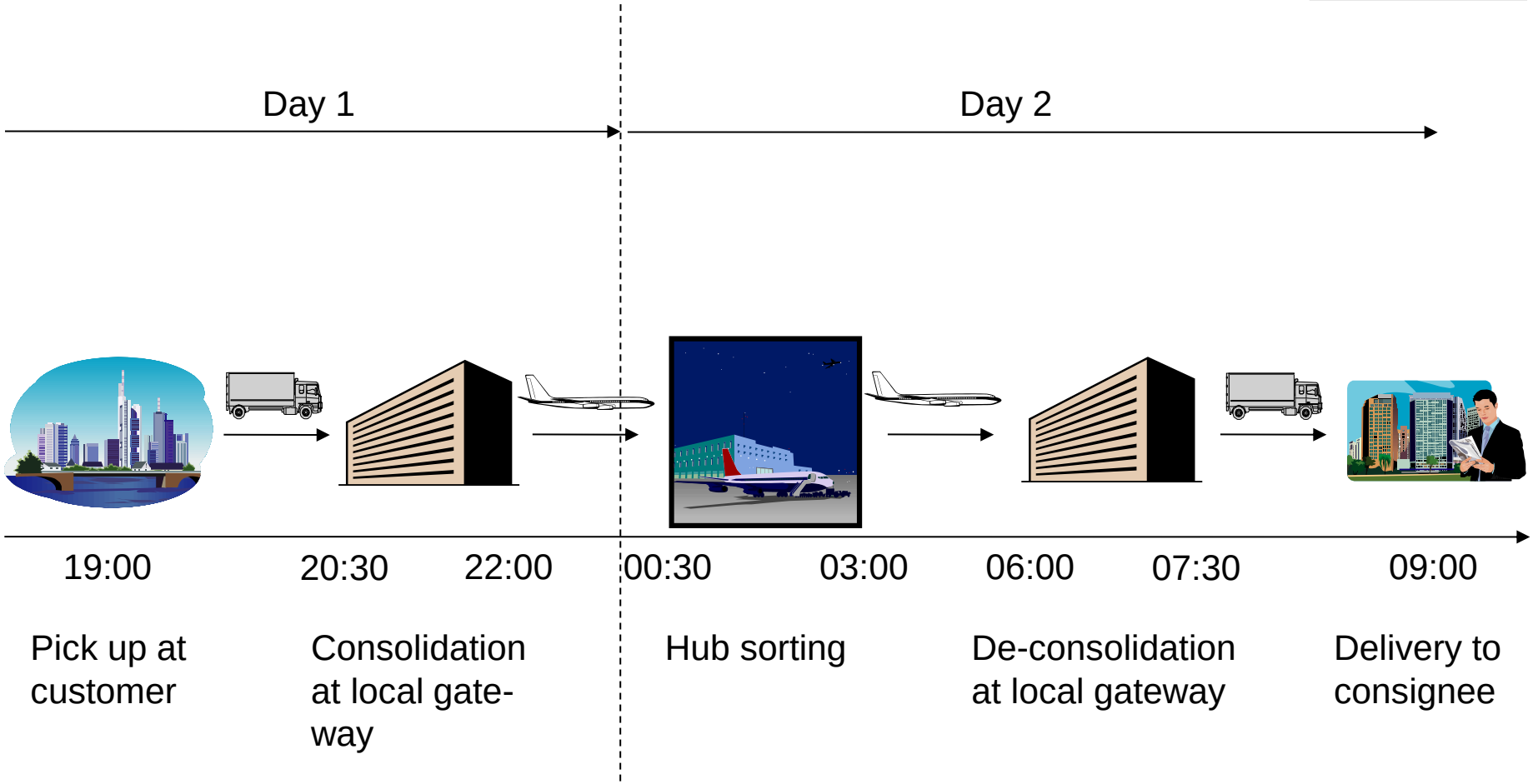
Service level definitions on postal code level

Delivery service level	Earliest delivery	Pickup service level	Latest pickup
‘09:00’	Before 09:00	‘19:00’	After 19:00
’12:00’	Before 12:00	‘17:00’	After 17:00
’15:00’	Before 15:00	‘15:00’	After 15:00

Market	Highest service levels	
	Delivery	Pickup
Business center	09:00	19:00
Major location	12:00	17:00
Regional destination	15:00	15:00

Today's integrator networks are designed to enable continental deliveries within 14 hours

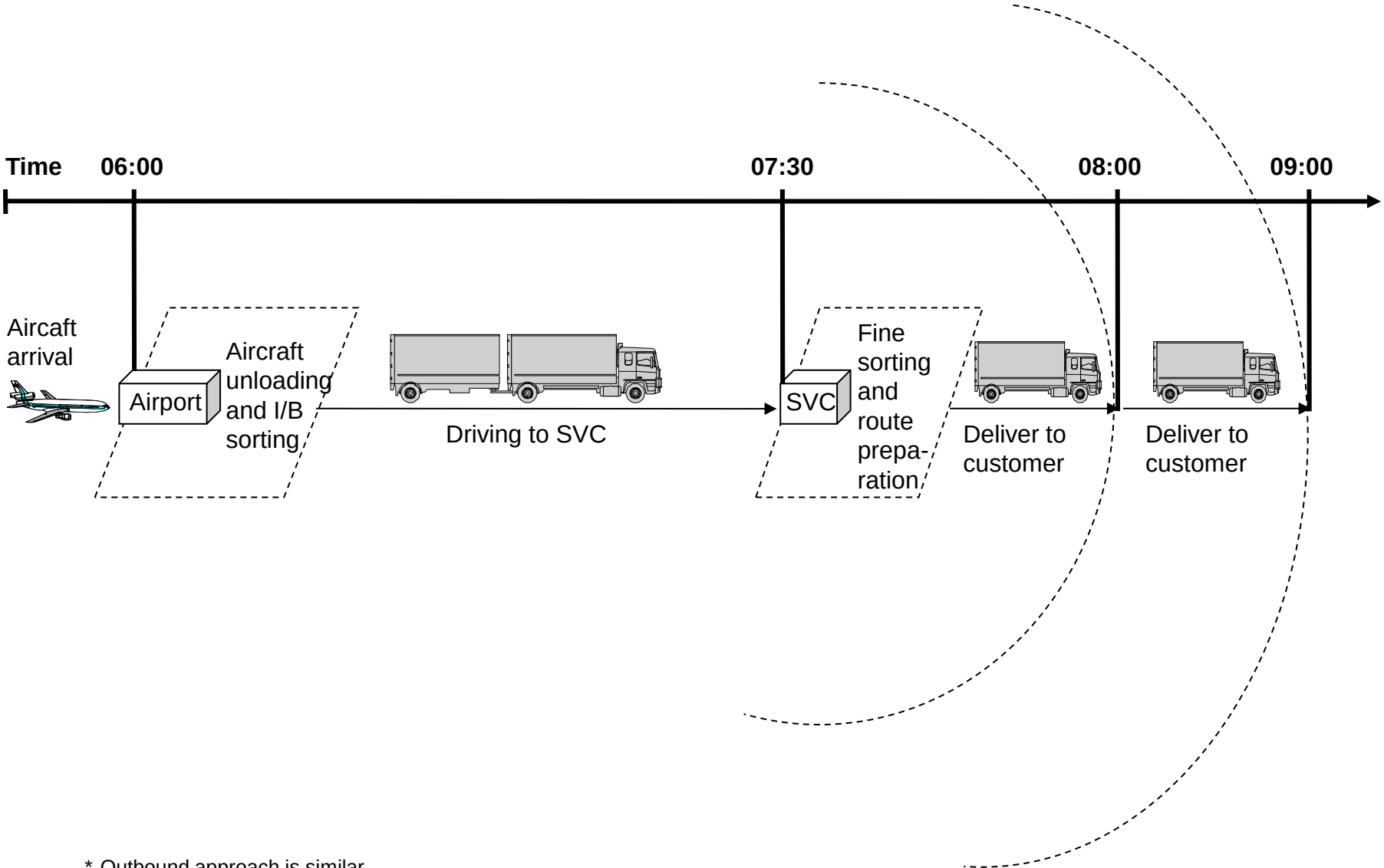
ILLUSTRATIVE



GROUND OPS ACTIVITIES REQUIRE IN TOTAL 3 HOURS

*INBOUND**

ILLUSTRATIVE



* Outbound approach is similar

KEY TO CURRENT MARKET CLASSIFICATION

Business centers

Code	Market	Country
AMS	Amsterdam	NL
ARN	Arlanda	SE
ATH	Athens	GR
BCN	Barcelona	ES
BER	Berlin	DE
BFA	Brussels elc	BE
BGY	Bergamo	IT
BRU	Brussels	BE
BSL	Basel	CH
CDG	Paris	FR
CGN	Cologne	DE
CPH	Copenhagen	DK
DUS	Dusseldorf	DE
FRA	Frankfurt	DE
GVA	Geneva	CH
HAM	Hamburg	DE
HEL	Helsinki	FI
LGW	Gatwick	GB
LHR	London-Heathrow	GB
LIL	Lille	FR
LNN	Lausanne	CH
LPL	Liverpool	GB
LYS	Lyon	FR
MAD	Madrid	ES
MAN	Manchester	GB
MIL	Milan	IT
MRS	Marseille	FR
MUC	Munich	DE
ROM	Rome	IT
STO	Stockholm	SE
TRN	Turin	IT
VIE	Vienna	AT
ZGN	St Gallen	CH
ZRH	Zurich	CH

Major locations

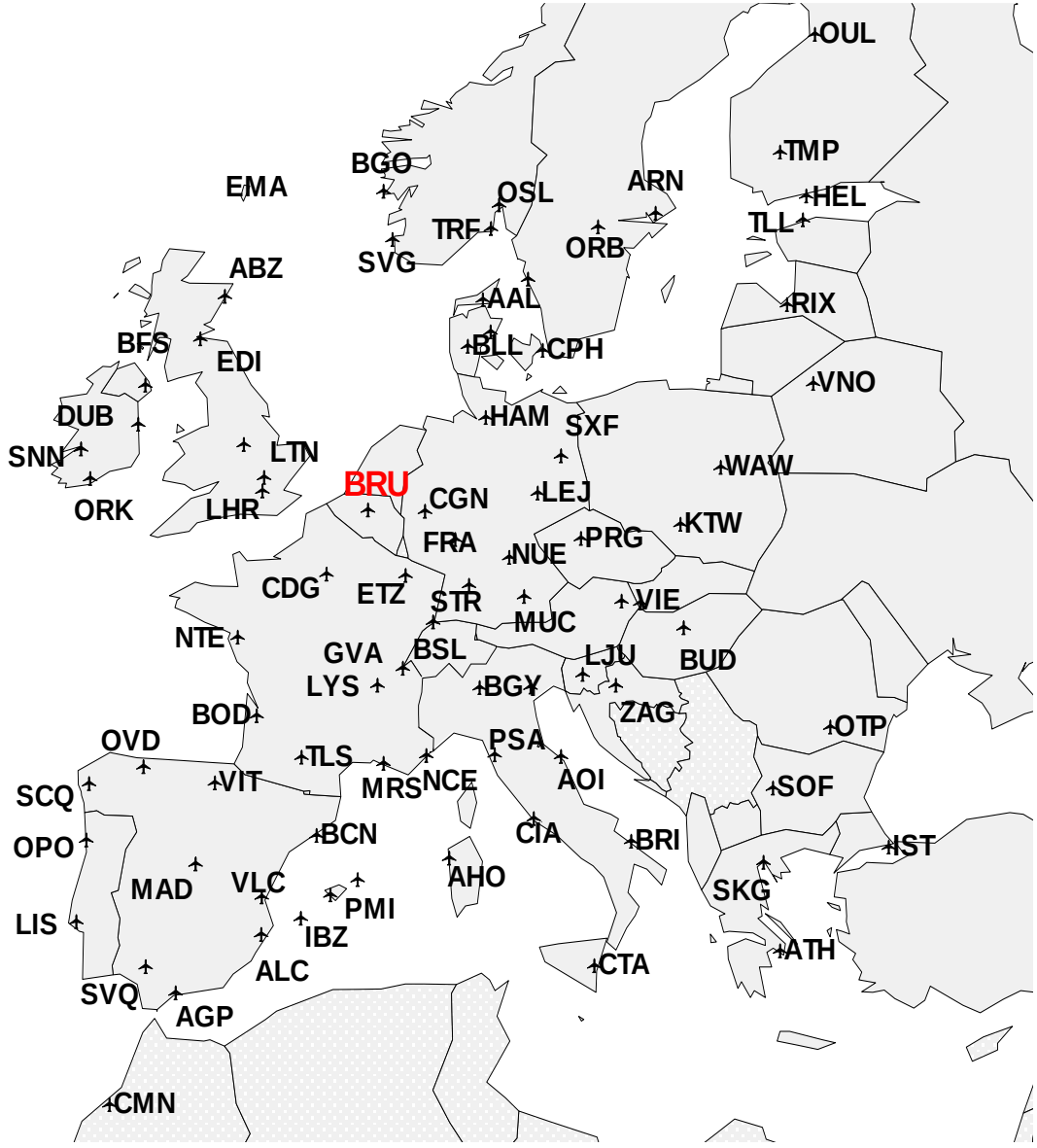
Code	Market	Country
ABZ	Aberdeen	GB
BFS	Belfast	GB
BGO	Bergen	NO
BHX	Birmingham	GB
BLQ	Bologna	IT
BOD	Bordeaux	FR
BRE	Bremen	DE
BUD	Budapest	HU
DTM	Dortmund	DE
DUB	Dublin	IE
EDI	Edinburgh	GB
FLR	Florence	IT
GLA	Glasgow	GB
GOA	Genoa	IT
GOT	Gothenburg	SE
HAJ	Hannover	DE
IEV	Kiev	UA
IST	Istanbul	TR
LBA	Leeds	GB
LED	St. Petersburg	RU
LIS	Lisbon	PT
LNZ	Linz	AT
LUX	Luxembourg	LU
MLH	Mulhouse	FR
MOW	Moscow	RU
MZM	Metz	FR
NAP	Naples	IT
NCE	Nice	FR
NCL	Newcastle	GB
NTE	Nantes	FR
NUE	Nuernberg	DE
OSL	Oslo	NO
PRG	Prague	CZ
QKA	Karlsruhe	DE
RED	Reading	GB
SOU	Southampton	GB
STR	Stuttgart	DE
SXB	Strasbourg	FR
TLS	Toulouse	FR
VCE	Venice	IT
VLC	Valencia	ES
VRN	Verona	IT
VST	Vasteras	SE
WAW	Warsaw	PL
XVQ	Seville	ES
XXA	Alicante	ES

Regional destinations*

Code	Market	Country
AAL	Aalborg	DK
AHO	Alghero	IT
AOI	Ancona	IT
BEG	Belgrade	YU
BLL	Billund	DK
BRI	Bari	IT
BTS	Bratislava	SK
BUH	Bucharest	RO
CTA	Catania	IT
EMA	East midlands	GB
ERF	Erfurt	DE
GDN	Gdansk	PL
IBZ	Ibiza	ES
IGL	Izmir	TR
JYV	Jyvaskyla	FI
KRS	Kristiansand	NO
KTW	Katowice	PL
LEG	Leghorn/Livorno	IT
LEJ	Leipzig	DE
LGG	Liege	BE
LJU	Ljubljana	SI
MAH	Menorca	ES
MMA	Malmoe	SE
MME	Teesside	GB
OPO	Oporto	PT
ORB	Orebro	SE
ORK	Cork	IE
OUL	Oulu	FI
OVD	Oviedo	ES
PSR	Pescara	IT
REK	Reykjavik	IS
RIX	Riga	LV
RNS	Rennes	FR
SCQ	Santiago de Composte	ES
SKG	Thessaloniki	GR
SKP	Skopje	MK
SNN	Shannon	IE
SOF	Sofia	BG
SVG	Stavanger	NO
TLL	Tallinn	EE
TRF	Sandefjord	NO
VAA	Vaasa	FI
VIT	Vitoria	ES
VNO	Vilnius	LT
XML	Malaga	ES
XZR	Zaragoza	ES
ZAG	Zagreb	HR

* Missing airport codes belong automatically to cluster ‘Regional Destinations’

EUROPEAN NETWORK



PROJECT SETUP (1/3)

Hub/gateway

Objectives

- Observe current operational constraints to maximize hub utilization and reliability
- Ensure nightly hub movements do not exceed maximum number allowed

Elements	Assumptions
• Hub production windows	• 00:00-04:00
• LEJ curfew window	• -
• Minimum hub connecting time – Sorted	• 02:00 hrs
• Maximum number of nightly movements – LEJ	• 36 per hour*
• Gateway slot/curfew restrictions	• No constraints

Air network

- Create a SSIM schedule with all operating flights
- Use block times from PACS
- Calculate network costs with PACS using specified cost settings

RFS network

- Add all RFS to SSIM schedule
- Determine realistic driving times, e.g. using map24

Commercial air

- For markets not connected with direct services, existing commercial air services can be used
- Commercial flights must be added to SSIM scenario schedule
- Commercial air rates: 0 – 999 km: 3.75€/kg
  1000-2000 km: 5.00€/kg
  >2000 km: 7€/kg
- Usage of commercial air is limited to 500 kg per route

* Flights must be distributed evenly, i.e. 3 flights per 5 minutes

PROJECT SETUP (2/3)

Approach

Vehicle types

- Use specified a/c types only
- Use given operating assumptions, including detailed payload range curves to ensure reliability and accuracy

Vehicle type	Gross capacity Tons	Max. net capacity Tons	Avg. speed km/h	Non stop max. distance nm	Turn-around time** Min	Taxi time*** Min
• A300	43.0	32.0	800	4,100	90	25
• B757	28.0	23.0	800	5.000	60	25
• B737	16.0	13.0	800	3,000	60	25
• Fokker 50	8.0	7.2	350	1,550	60	25
• ATR42	5.6	5.2	350	1,550	45	25
• EM120	3.5	3.5	350	1,550	45	25
• Truck	24.0	24.0	70	N/A	45	N/A
• Van	2.0	2.0	80	N/A	30	N/A

Minimum connect times (non-hub)*

- Use connection times depending on the turnaround times of the involved A/C

I/b – o/b v.v. vehicle type	MCT (Min)	I/b – o/b v.v. vehicle type	MCT (Min)
• B757/B737 - B757/B737	60	• B757/B737 - TRK/Van	45
• B757/B737 - A300/B767	90	• A300/B767 - TRK/Van	45
• A300/B767 - A300/B767	90	• Jet - MD11	90
• B757/B737 - Feeder	45	• Feeder - MD11	90
• A300/B767 - Feeder	45	• Feeder - TRK/Van	45
		• TRK/Van – TRK/Van	45

** Includes aircraft unloading and loading

*** Total taxi time required, i.e. sum of taxi-in and taxi-out time

PROJECT SETUP (3/3)

Approach

Aircraft Cost

- All aircraft are leased according to ACMI leases
- Use Ramp + RPK in PACS to determine the sector cost

	737	757	ABF
ACMI/hour	$ 2,500	$ 3,000	$ 3,500
Landing and parking fee	$ 700	$ 1,200	$ 1,700
Ramp handling fix	$ 1,250	$ 1,250	$ 1,250
Ramp handling rate per kg	$ 0.05	$ 0.05	$ 0.05

	EMB120	ATR42	Fokker 50
ACMI/hour	$ 2,000	$ 1,800	$ 1,900
Landing and parking fee	$ 300	$ 500	$ 600
Ramp handling fix	$ 750	$ 750	$ 750
Ramp handling rate per kg	$ 0.10	$ 0.10	$ 0.10

Fuel cost for all sectors: $1.50 per gallon

RFS Cost

- Use the following costs for ground transports

	Annual Fixed cost	Variable cost per km
Truck	50.000,00 €	0,60 €
Van	30.000,00 €	0,30 €

OBJECTIVES

- **Develop the European air and ground network of the integrator with LEJ as the main hub**
- **Create a sample week SSIM schedule, starting on <u>Monday, 11 Jan 2017</u>**
- **All high yield volumes must be transported**
- **The specified service levels must be met**

AVAILABLE DATA: High Yield Volume flows.txt

- **Data for the sample week starting Monday, 11 Jan 2017, with daily high yield volume flows. Data is reported between gateways.**
- **ASCII file contains following data:**
  - **Departure Gateway**
  - **Arrival Gateway**
  - **High yield volumes (in kg)**
  - **High yield rpk (revenue rate per kg in €)**
  - **Departure region**
  - **Arrival region**
  - **Pick up date**
- **All fields are separated by a comma; the first row contains a header**

AVAILABLE DATA: Gateway.xls

- **Excel table with gateway codes (1st column) and city codes (2nd column)**

AVAILABLE DATA: Low Yield Volume flows.dat

- **ASCII file contains average daily low yield demand. Every fraction of the low yield demand can be accepted.**
- **ASCII file contains following data:**
  - **Departure City**
  - **Arrival City**
  - **Low yield volumes (in kg)**
  - **Low yield rpk (revenue rate per kg in €)**
- **All fields are separated by a comma; the first row contains a header**