

# I. Ground handling operations: a technical perspective

## 1. Overview

We can distinguish two major types of ground handling procedures which are designated as either terminal or airside operations. For our technical analysis, we will focus on airside operations as the complexity of tasks and the diversity of required equipment are great. First, we should define the whole range of operations that ground handlers deal with. The following list is an exhaustive for common commercial flights<sup>1</sup>:

### *Ramp services*

- Supervision
- Marshaling
- Start-up
- Moving/towing aircraft
- Safety measures

### *On-ramp aircraft services*

- Repair of faults, fueling, wheel and tire check
- Ground power supply
- Deicing, cooling/heating
- Toilet servicing, potable water, demineralized water
- Routine maintenance
- Non-routine maintenance
- Cleaning of cockpit windows, wings, nacelles and cabin windows

### *Onboard servicing*

- Cleaning
- Catering
- In-flight entertainment
- Minor servicing of cabin fittings
- Alteration of seat configuration

### *External ramp equipment*

- Passenger steps
- Catering loaders
- Cargo loaders, mail and equipment loading

Obviously, ground handling management has to deal with very diverse tasks. Preferably, these operations are performed simultaneously to decrease ground time and thus to increase aircraft productivity. Airlines pay at the most part for the delays that their aircrafts experience. Therefore, they strongly emphasizes the time-efficiency of ground operations provided either by themselves, or the airport authority or independent companies. It makes the task even tougher for ground handlers whose efficiency relies on technology-advanced equipment, coordination of staff and information support systems.

---

<sup>1</sup> *Airport Operation, Second Edition*, written by Norman Ashford, H.P. Martin Stanton & Clifton A. Moore (p160)

## 2. Equipment

In terms of ground handling equipment, we found out that available products are numerous. It would not be very relevant to analyze thoroughly every company with all their products. However, we contacted Regis Lacote who is the manager in charge of the ground handling operations performed by ADP<sup>2</sup>. He provided an exhaustive list of all equipment ADP owns which gives a good overview of what a typical airport authority needs to operate ground handling<sup>3</sup>. The list below summarizes what equipment is basically required:

\_ Tow-bars: they make it possible to tow a given aircraft by a tractor which is clipped to the bar. The main advantage is that you need only one type of tractor to tow all types of aircrafts. The main disadvantage is the high number of staff required to fix the bar to the aircraft.



*Fig1*

\_ Push-back tractors: it is a good alternative to tow aircrafts as tow-bars are not always required. On the other hand, these devices are much more expensive than universal tractors coupled with tow-bars.

\_ Forklifts: they are used to carry palettes especially when ground handling operations deal with freight.



*Fig 2*

---

<sup>2</sup> “Aéroport de Paris”, name of the Paris Airport Authority

<sup>3</sup> See Appendix 1

\_ Steps: they are available with or without canopy.



*Fig 3*

\_ GPU: these units provide aircrafts with electric energy. They can be either mobile or static. As the legislation is becoming very restrictive in terms of gas emissions at airports, the utilization of autonomous energy source as APU becomes very limited. Therefore, GPU are used more and more often. The energy source of mobile units is mostly diesel.



*Fig 4*

\_ Loader: They are used to carrying heavy loads between 3.5 and 14 tones. This can include baggage containers.



*Fig 5*

\_ Dollies

\_ Belts: they are used mostly to carrying smaller loads and baggage when they are not packed in containers.

\_ Tractors

\_ Transporteurs: they facilitate the transport of containers.



*Fig 6*

ADP operates 16 000 arrivals and 16 000 departures a year with this equipment. It generates about 45 million euros as revenues.

This brief description of what equipment ground handlers need shows that these activities require huge investments. Equipment is very diverse and the required number of each device is high. It illustrates how difficult it can be for independent handlers to penetrate a market. Airlines prefer dealing with only one ground handling service provider for a given flight so independent handlers are required to buy all this equipment which represents a great amount of money.

Then, we can notice that most of ADP's equipment is produced by the same company TLD-GSE. This brand regroups several brandnames such as ACE, Albret, ERMA and sells a lot of products which cover most of ground handling operations. We can assume that ADP is able to negotiate better prices as they purchase many products of the same company. Once again, it seems like size is a very important factor to ensure profitability.

### 3. Operational analysis

#### a. Layout of operations

As we can see on figure 7, ground handling is a multi-task procedure. Since managers want to save some money for the airlines they work for, they endeavor to perform simultaneously as many operations as they can.

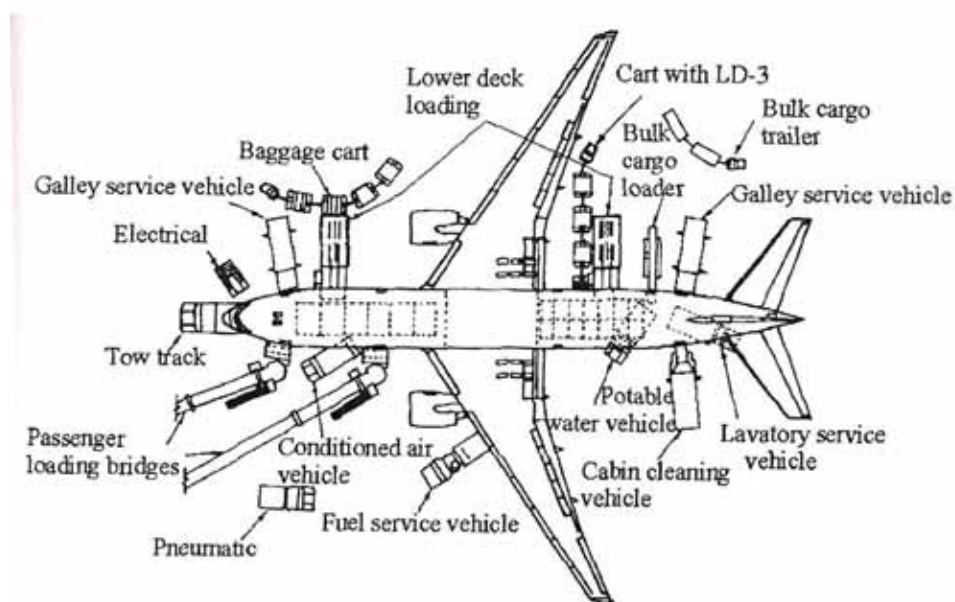


Fig 7

*The B-777 being serviced during a turnaround with the help of ground support systems and mobile equipment*

*Source: Boeing 777 Airplane Characteristics for Airport Planning*

This layout raises the important issue of equipment damages that can occur during operations. The equipment density around the aircraft is very high and may lead to frequent incidents. In fact, a survey was conducted by ACI in November 1998 with 313 participating airports. The survey reported 671 incidents during handling of 2 133 398 movements, giving a rate of one incident per 3180 movements<sup>4</sup>. It shows that the frequency of accidents is low but a further analysis proved that a majority of accidents could have been avoided if fixed ground systems would have been used. On figure 8 below, all equipment to equipment damage and parts of equipment to facilities damages as well as damage to/by moving aircraft would have been avoided.

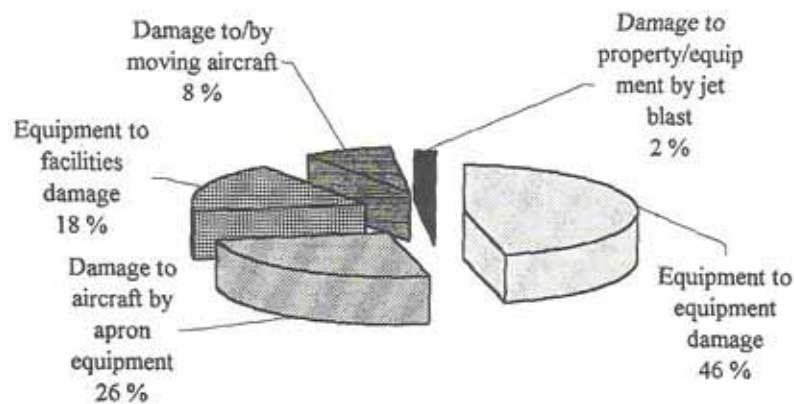


Fig 8

*Apron incidents/accidents – causes of damage (1994-98)*  
*Source: ACI Survey on Apron Incidents/Accidents (November 1998)*

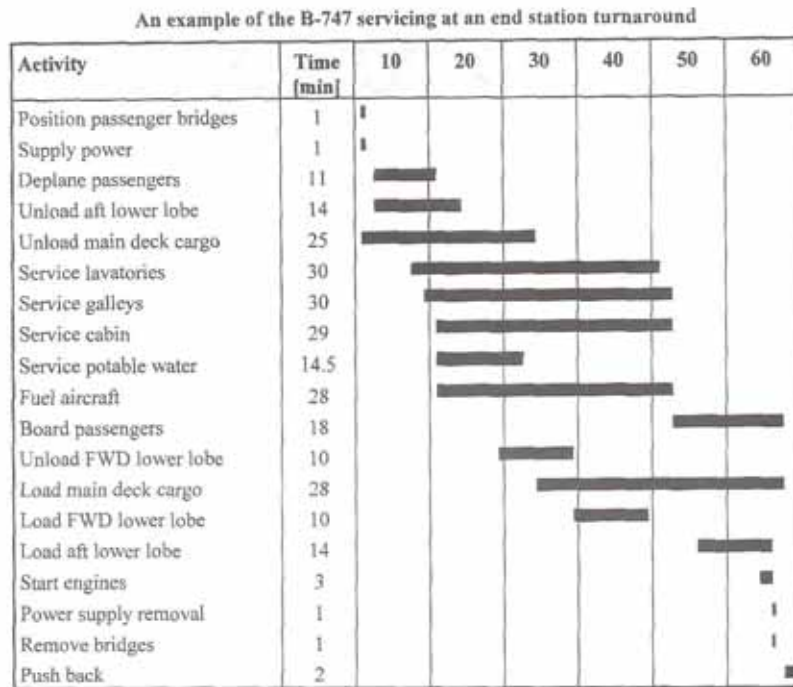
These results illustrate the trade-off between fixed systems and mobile units that ground handlers and mostly airport authorities have to deal with. On the hand, mobile units are more adaptable, they require less investment but they may cause severe damages. On the other hand, fixed ground systems are safer and reduce gas emissions, but they cost a lot of money and they are not as adaptable to any type of aircraft as mobile units. In conclusion, the equipment listing provided by ADP shows that a large stock of mobile units is necessary to ensure the tremendous flexibility required in ground handling.

<sup>4</sup> *Airport Design and Operation*, written by Antonin Kazda and Robert E.Caves, p117

## b. Timing

Table 1 below is an example of the B747 servicing at an end station turnaround. As we can see, many tasks are performed simultaneously given the layout of operations above. The turnaround time is about 60 minutes but this time can be much shorter in the case of regional jets. Usually, ground handling operations are supposed to be finished within 20 minutes which leaves no room for error.

*Table 1*



## c. Management and organizational issues

The tighter the operational schedule is, the more important the operational management is. Table 2 shows that ground handlers have sometimes to deal with uncertainty. If a breakdown occurs because of an equipment failure, the operation manager has to make a choice depending on the importance of the interrupted operation. If the flight does not rely on this operation, the manager may decide to cancel or to shorten it. Particularly, we think about freight and mail loading. Indeed, delays experienced by the aircraft may cost more money than loading can make. Moreover, managers take care of coordinating all workers on tarmac in order to ensure safety of staff and equipment and to be time-efficient.

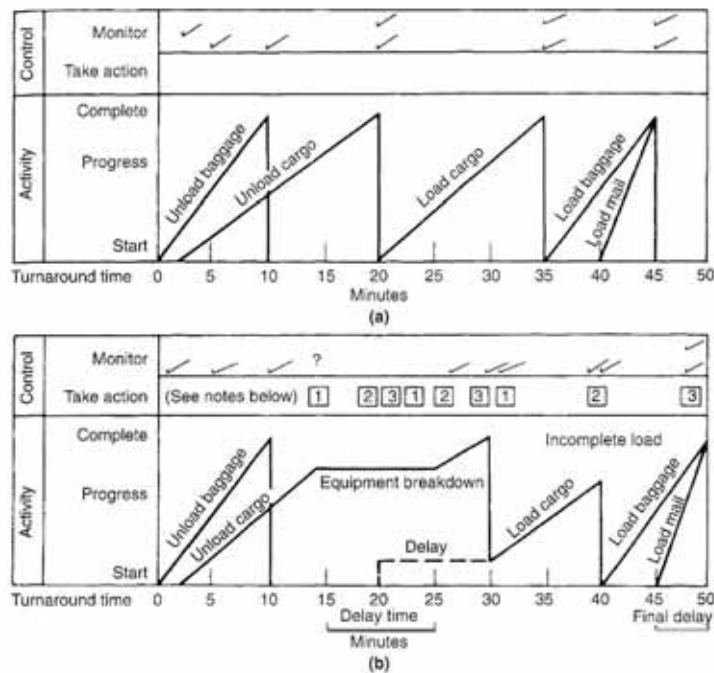


Table 2

Effect of breakdown and delay on apron dispatch, (a) Activity normal, no control action; (b) delay through breakdown control required. Action 1 Assess the nature of the problem and how long the problem (breakdown of the cargo loader) will take to sort out. Action 2 Take corrective action immediately or call equipment base and ask engineer to come to the aircraft immediately or call up a replacement loader. Action 3 Advise all those other sections/activities that will be affected by the breakdown and give them instructions as necessary (e.g., notify movement control of a delay, tell passenger service to delay boarding, etc.)

Regis Lacote gave us some more information about staff and managers working on tarmac. In fact, ADP hires employees who provide only supervision and loadmastering of flights. All other operations are outsourced and performed by two companies. Regis Lacote confirmed the order of magnitude of engagement time. For a typical 767-200 arriving flight, staff are engaged between T-15 and T+45 in minutes. For a typical 767-200 departing flight, staff are engaged between T-60 and T+15. Usually, the team is composed of 4 workers and one manager. Each worker has specific driving licenses and ground handling managers have to make sure their teams can operate the required equipment.

Finally, we can notice that the small number of team members provides the flexibility that ground handlers need most.

## 4. Conclusion

Ground handling deals with very complex operations. Even though heavy equipment is required to perform the tasks during a turnaround, flexibility is the key point to reach maximum efficiency. Therefore, adaptability skills of all workers and managers are crucial.

## II. The ground handling market in the US

In this second part, the objective is to provide an overview of the current ground handling market in the US. As compared to the rest of the world, the American market is very unique because only a small proportion of these operations are performed by independent companies. Most of ground handling performed in the US is managed by the airlines themselves while European airports used to have a monopoly over this market<sup>5</sup>.

We extracted all data from form 41. Quarterly, it reports all operational and financial data of American airlines.

### 1. Labor analysis<sup>6</sup>

Based on our analysis of airlines' employees, we found out that legacy and lowfare carriers differed greatly with regard to their ground handling staff. On the one hand, legacy carriers have important cargo activities. On the other hand, lowfare carriers do not focus on these marginal revenues. As a result, they have either no or very small staff. It can be seen on figure 10. We can assume that legacy carriers have much more valuable opportunities to perform cargo operations as many of them operate international flights. Then, it must be easier to organize cargo handling when you operate a hub and therefore you have priority over all other carriers. Since cargo operations require more time and more space, an airline operating at its hub must be in a better environment to perform this kind of operations.

However, we can notice that the relative proportion between passenger handling staff and general A/C and traffic handling staff is a constant throughout the airline industry and is equal to about 2.

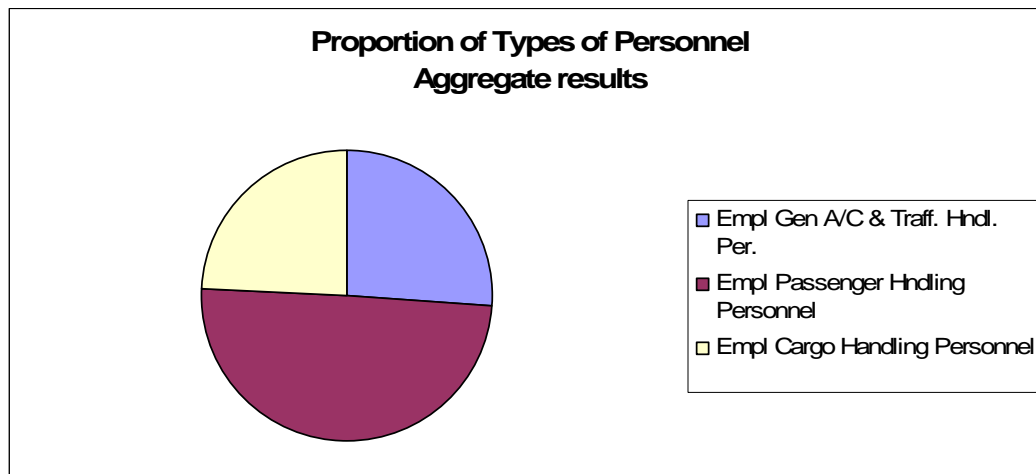


Fig 9

<sup>5</sup> Find details in *Airport Operation, Second Edition*, written by Norman Ashford, H.P. Martin Stanton & Clifton A. Moore (p178)

<sup>6</sup> See form 41 sheet P010



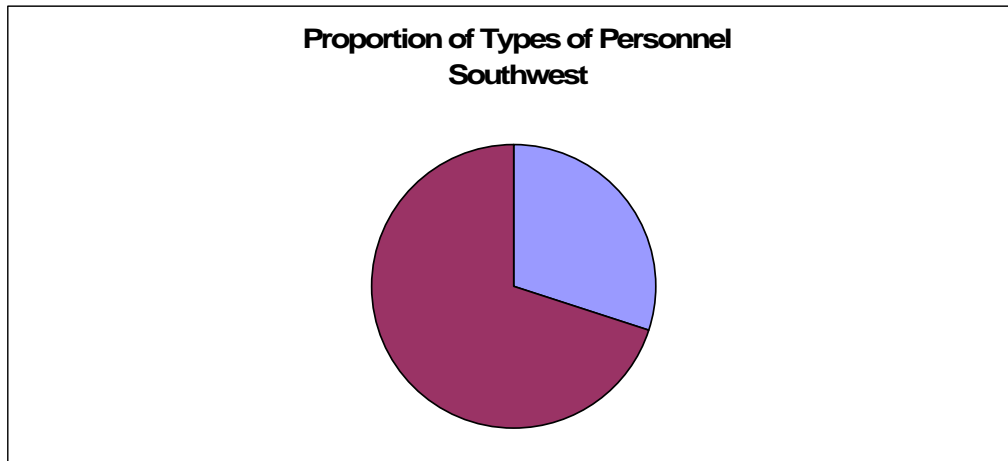


Fig 10

## 2. Market volume<sup>7</sup>

Similarly to the trends of the American airline industry, the ground handling market increased tremendously from 1995 to 2002. After 9/11, legacy airlines which carry the vast majority of the traffic cut capacity which resulted in a decrease in ground handling operations. On figure 11, these two trends are obvious and it shows that the ground handling market can be changing as quickly as the airline industry.

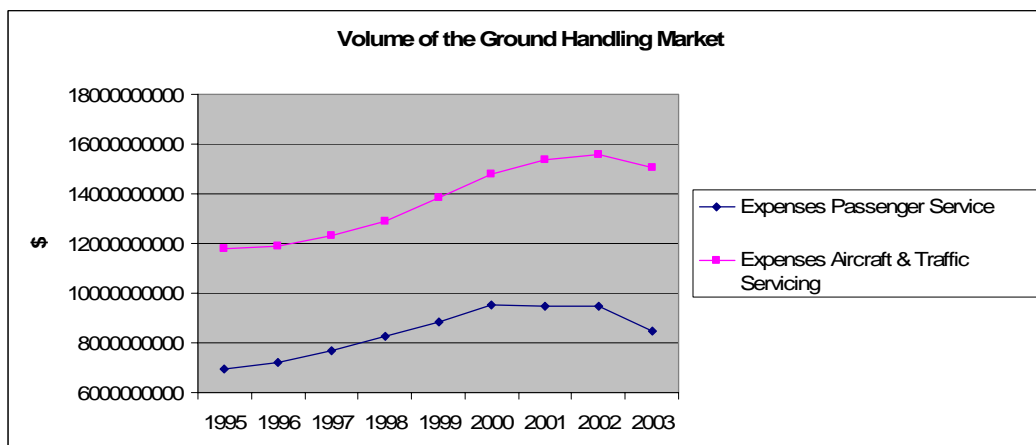


Fig 11

Figure 12 shows how airlines reacted after the airline industry downturn following 9/11. It shows that aircraft servicing per ASM increased from 1995 to 2002. At this time, airlines were willing to improve ground handling efficiency. Therefore, they invested large amounts of money which certainly resulted in reducing turnaround time and improving level of service. After 9/11, they stopped focusing on time-efficiency to focus on cost-efficiency as the whole industry faced major financial difficulties. Since they could cut costs on passenger service, they did. Apparently, it was more difficult and maybe not very reasonable to cut on aircraft servicing as a huge proportion of aircraft productivity relies on ground handling. Finally, aircraft servicing expenses per ASM remained constant while passenger servicing

<sup>7</sup> See form 41 sheet P012, P017 and P060

expenses decreased tremendously. Figure 13 illustrates the same trend by showing changes in property and equipment related to ground handling per ASM.

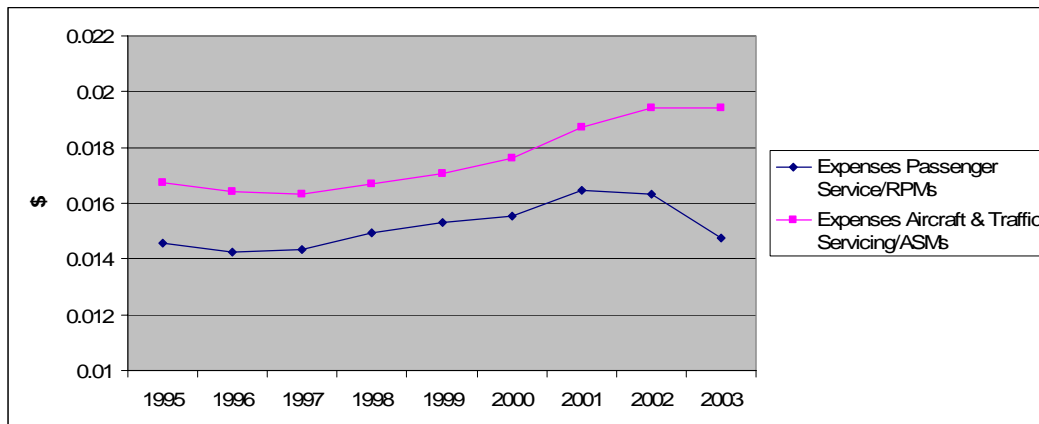


Fig 12

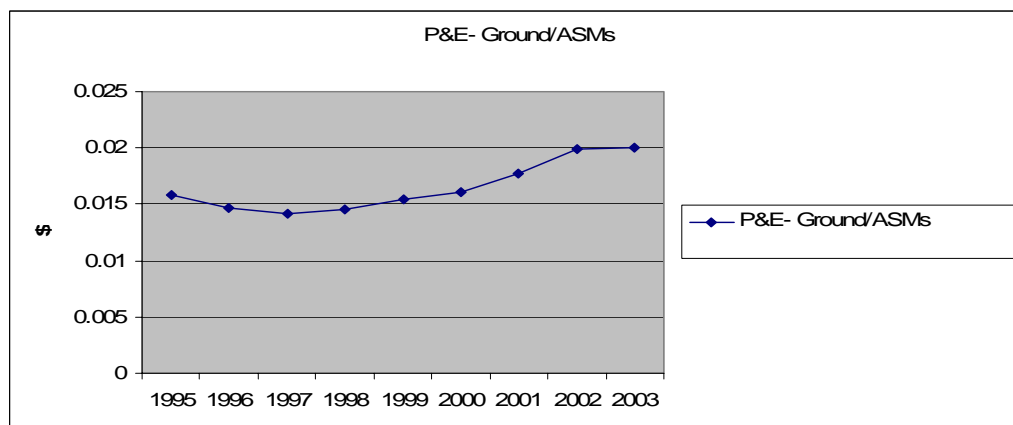


Fig 13

### 3. Specific expenses

As we can see on figure 14, airlines have started cutting all expenses related to onboard services since 2000. Facing the intense competition of lowfare carriers, legacy carriers had no choice and cut these expenses to lower unit costs. As a result, they first cut jobs and renegotiate contracts of flight attendants. Then, they reduce food and other in-flight services tremendously. On figure 15, it is even more obvious when these expenses are compared to RPM. We can notice that the decrease has been strengthened by the post 9/11 downturn of the airline industry.

Finally, we infer that airlines are not willing to spend large amounts of money in food expenses any more. This trend is unlikely to change as the competition of lowfare carriers which provide a very low in-flight level of service is not weakening.

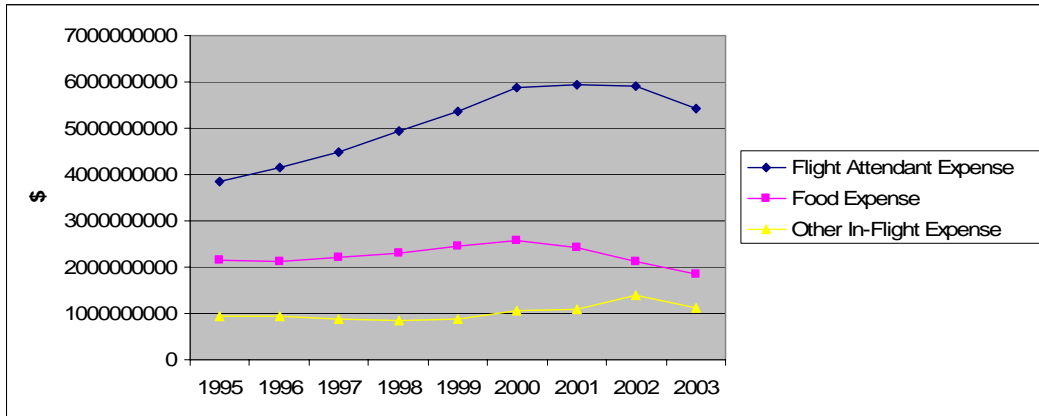


Fig 14

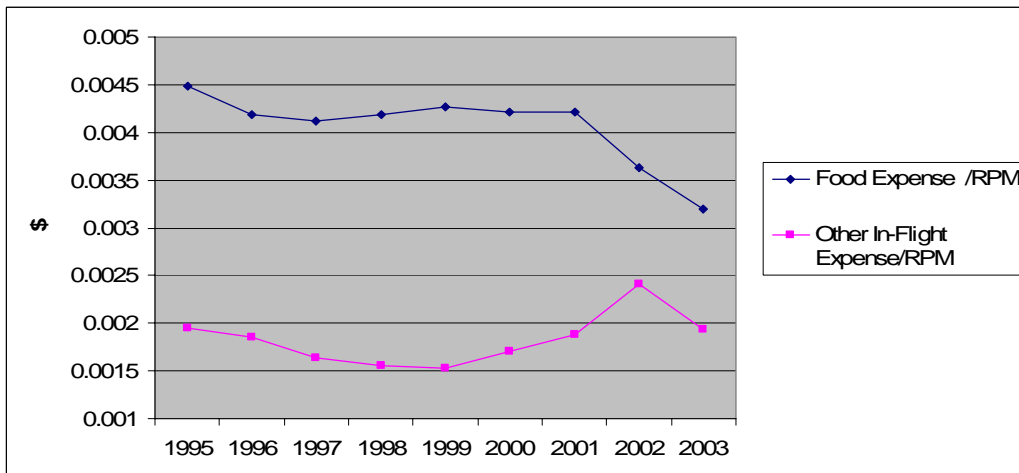


Fig 15

## 4. Conclusion

Ground handling costs a lot of money to the American airlines. They are willing to limit these expenses but there is a trade-off between cost-efficiency and time-efficiency. Indeed, a very efficient ground handling management can improve aircraft productivity and generate more revenues. Therefore, we see that aircraft handling costs per ASM remained constant even though airlines are facing major difficulties. However, other expenses related to food and services like in-flight entertainment are drastically reduced as they are not necessary and customers are less demanding.

### III. The case of the European Union: the new environment since deregulation

#### 1. The Council Directive 96/67/EC<sup>8</sup>

This Directive was adopted on 15 October 1996 as a strong commitment towards liberalization of the ground handling in the European Union.

##### a. Objectives

The Directive is focused on several points defined in the introduction. It was adopted at a time when the European Council wanted to strengthen the liberalization of the air transportation market. Indeed, EU introduced common air policies with the EU third package (1/1/93) which largely deregulated the European airline industry within the European territories.

In the specific Directive we are studying, the three following aims turn out to be the most relevant to our economical analysis:

- To promote economic and social progress thanks to progressive liberalization
- To improve quality of service
- To decrease costs related to ground handling activities in general

However, the Directive admits that this market is specific and must be managed wisely to make a transition as smooth as possible. In fact, airports have to deal with environmental and space constraints, as well as sometimes with the consequences of several decades of monopoly. Therefore, the Directive allows EU partners to ask for restrictions or exemptions for definite location and period of time. Thanks to these measures, the liberalization should be more progressive and controlled.

##### b. Contents

By 1 January 2001, the directive requires the following:

➤ *Freedom of third party handling (Article 6).* If the traffic is higher than 2 million passengers or 50 000 tonnes of freight per annum, the Member State is allowed to reserve the right to self-handle to no fewer than two airports users for the four following categories:

- Baggage handling
- Ramp handling
- Fuel and oil handling
- Freight and mail handling

---

<sup>8</sup> See Appendix 2

Moreover, at least one of these two providers must be independent of the airport and any dominant carrier at this airport. If constraints of available space or capacity limit the number of possible ground handling providers, there should be a minimum of one handler. For smaller airports, a minimum of two handlers is required with at least one independent provider.

➤ *Freedom of self-handling (Article 7)*, which applies regardless of the volume of traffic at any given airport. If the traffic is more than 1 million passenger movements or 25000 tonnes freight per annum, the Member State is allowed to reserve the right to self-handle to no fewer than two airports users for the four following categories:

- Baggage handling
- Ramp handling
- Fuel and oil handling
- Freight and mail handling

If constraints of available space or capacity limit the number of possible ground handling providers at the airport, the Member State may be exempted of complying with this market open-up. Then, the restriction is total.

➤ *Centralized Infrastructure (Article 8)*. If ground handling activities require complex system with an important environmental impact, the Member State is allowed to centralize equipments and arrange a fair selection and allocation of resources.

➤ *Separation of accounts (Article 4)*. This measure aims at preventing airports from sponsoring their ground handling activities by other revenues such as landing fees. It should increase transparency and competition between ground handling providers.

### c. Exemptions (Article 9)

Airport operators are allowed to seek exemptions but they must be temporary. Operators must notify the European Commission which can approve or disapprove this decision. Eventually, a conflict can be a matter to the European Court of Justice if an agreement cannot be reached.

## 2. Results

### a. Market penetration

The figures below show the global trends of the ground handling market since deregulation. 34 major airports of the EU have been visited by the consulting firm SH&E Limited and their results prove that the deregulation has had a strong impact on the competition in this sector.<sup>9</sup>

---

<sup>9</sup> Note that the term “third party handlers” refers to any ground handler provider different from the operating carrier. (EU legal definition)

First, figure 16 shows a significant increase in the number of passenger third party handlers. The directive has certainly contributed to enhance competition and airlines have now more opportunities to outsource their ground handling activities. It doesn't mean that airlines decided to quit the market given the fact that the number of passenger self handling has not significantly decreased. On the contrary, there must be several airlines that decided to expand their activities by providing third party services to other smaller carriers.

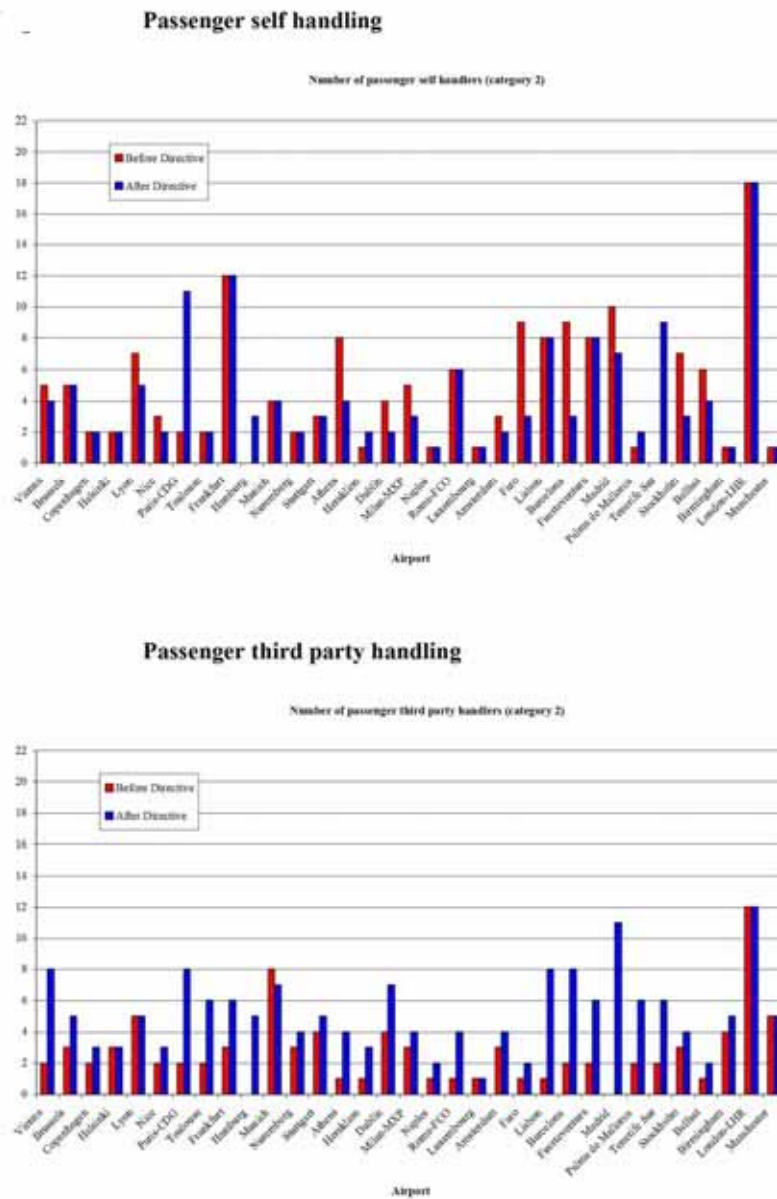


Fig 16

If we analyze the baggage handling market, we can notice that it has not changed as much as the passenger handling market. In fact, a few carriers in the EU undertook baggage self handling before deregulation which did not enhance arrival and expansion of competitors on the market. Then, baggage handling is more space constrained than passenger handling so changes are smaller. However, the global trend of the baggage handling market is an increase in the number of third party handlers. Finally, competition has been enhanced.

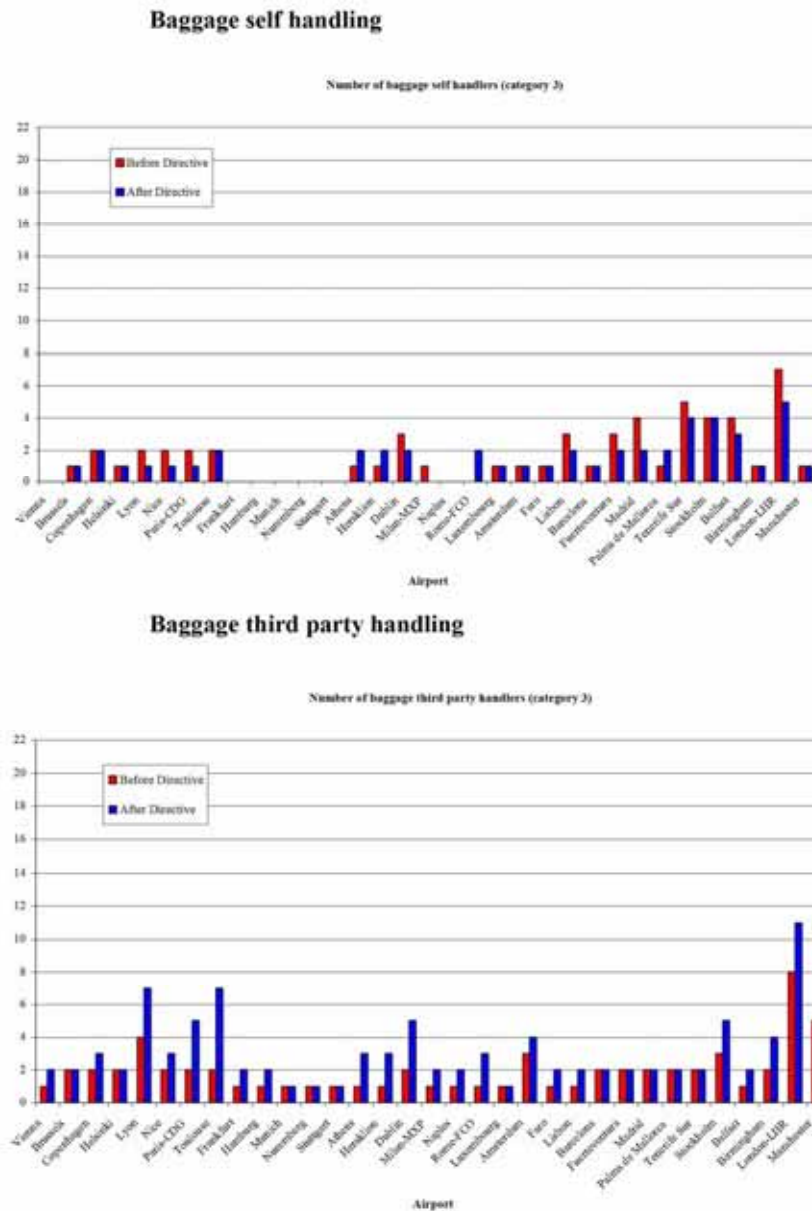


Fig 17

The trend is similar in the ramp handling market. The number of self handlers has not changed tremendously even though the Directive created some self-handling opportunities in Dublin or Roma. However, the number of ramp third party handlers has increased considerably. The only exception is Spain because a reform took place before the Directive.

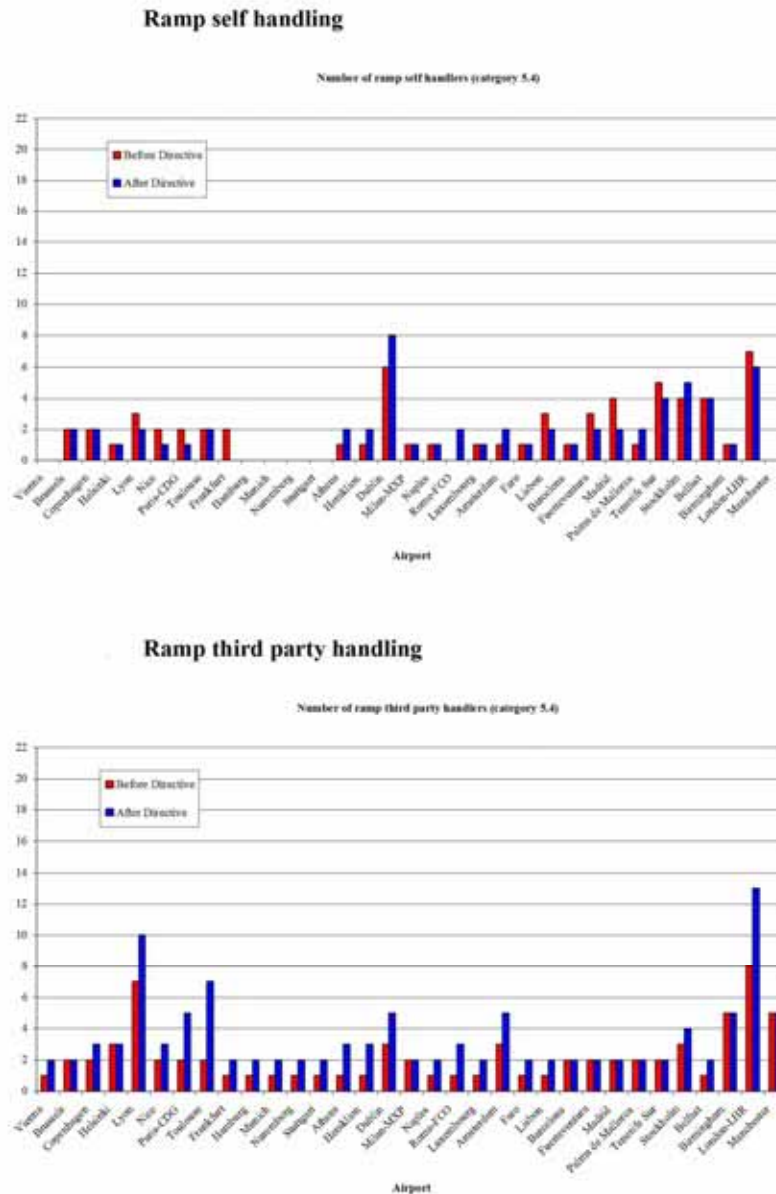


Fig 18

Finally, the Directive has achieved to promote liberalization as mentioned in its introduction. Obviously, enhanced freedom of self-handling and third party handling has had strong impact on the market. Competition must be more intense than before the implementation of the Directive. An analysis of changes in prices would be relevant to prove that the Directive was wise to enhance freedom if a decrease in costs was one of its main goals.



## b. Price and quality analysis

Table 3 below shows that a global decrease in prices occurred from 1997 to 2001. According to a majority of ground handling providers that have been questioned, this decrease is more a result of a very intense competition in the airline industry than a direct consequence of the implementation of the Directive. However, the new liberalized market environment strengthened certainly this trend. Moreover, the decrease in prices was larger in countries with former handling monopolies (e.g. Greece and Italy). Prices went down by more than 20% which is very significant within the short period of time we consider. However, we should notice that some airports in the EU do not currently comply with the rules defined by the Directive. Several exemptions were granted for the following airports within Germany: Berlin/Tegel, Cologne/Bonn, Düsseldorf, Frankfurt, Hamburg, and Stuttgart. There, the decrease in prices may have been less than expected.

Estimating changes in quality is a very tough task. SH&E limited has performed a survey by questioning airports, handlers and customers on this issue. However, the results differed greatly from one to another. For example, the answers given by handlers cannot be considered objective because they defend their products. Then, it appeared that results that customer satisfaction was different even for customers within the same airport. Finally, no conclusion could be drawn.

In conclusion, the Directive seems to have been efficient to create an environment enhancing competition. It resulted in reduced prices but we do not have enough accurate data to estimate changes in ground handling quality. The international competition in the airline industry makes it necessary to ensure competitiveness of European markets. Therefore, the European Council endeavors to enhance liberalization and in this way to promote economic progress within the EU.

Airport	Airport operator	Airline	AUC	AOC	Handler
Vienna	-15%	Austrian Airlines: -5%	-5%	-10%	VAS: no insight
Brussels	Increase	Lufthansa: increase	No change		BGS: no change Aviapartner: no change
Copenhagen	Decrease			-10 to -15%	Novia: decreased SAS: frozen <sup>1</sup>
Helsinki	No insight	British Airways: no change		Stable	GlobeGround: no major change Finnair: -30% to -40% Fortum: no change
Lyon	-50%	Brit Air: no change	Slight decrease		Aviapartner: -20% Servisair: -20%
Nice		Air France:			Swissport: lower

*Table3*

		no change			
Paris-CDG	-20%	Lufthansa: +8%	Slight decrease		
Toulouse	Decrease		Slight decrease		Servisair: -20% Aviapartner: -20%
Frankfurt	-5% to -15%	British Airways: significant decrease	-10%	No change	Acciona Airport Services: decrease
Hamburg	-5% to -15%		No insight	No insight	Checkpoint B: -15% to -20% Swissport and Menzies: -10% to -15%
Munich	-15%	British Airways: -15% to -25%	Frozen		Aviapartner: -20%
Nuremberg	-10% to -20%	Eurowings: -15%	Frozen		Aviapartner: -20%
Stuttgart	Decrease	Alitalia: no change	-15% to -20%	Decreased	Servisair: airlines expected -25% Aerogate: decreased
Athens	-30% to -40%		Decrease		Swissport: -40% Goldair: large discounts
Heraklion			-15%		
Dublin	No insight	Ryanair: no insight Aer Lingus: +10%	No change		Servisair: -5% to -7.5% Aviance: no insight
Milan-MXP	-20%				
Naples	-25%		No change		
Rome-FCO	-10 to -25%	Alitalia: Decrease			EAS: -30%
Luxembourg	No change	Cargolux: increased	Increase	Decrease	CSLUX: frozen Luxair: frozen
Amsterdam	-5% to -10%	KLM: Decrease <sup>2</sup>		Decrease	GlobeGround: Decrease <sup>2</sup>
Faro	Decrease	Charter airlines: -10%	Decrease	Decrease	Portway: -25% TAP Handling: -15%
Lisbon	Significant reductions up to 50%	Lufthansa: -20%	Decrease	Decrease	Portway: -10%
Barcelona	Decrease			Decrease	Iberia Handling: decrease
Fuerteventura	Decrease				
Madrid	Decrease		Decrease		Ineuropa and Iberia Handling: decrease
Palma de Mallorca	Decrease		Decrease		Ineuropa: -20%
Tenerife Sur	Decrease		-20%		
Stockholm	-20% to -30%	Skyways: -10 to -15%	No change	Decrease	Air Cargo Center: slight decrease Novia: -20% to -30% Servisair: decrease
Belfast	No insight	BMI: no insight	No insight	No insight	Servisair: -10% Aviance: -5%
Birmingham	Decrease	Aer Lingus: frozen	Frozen		Groundstar: no change

		British Airways: slight increase			Servisair: no insight Aviance: frozen
London-LHR	No comment	American: -20% Malaysia Airlines: -10% to -40%	No comment	No comment	Swissport: -25% to -30%
Manchester	+10% <sup>1</sup>	Monarch: no change			Aviance: -20% since 1992 Ringway: no change Servisair: -10% to -15%

(1) But off peak prices are estimated to have decreased up to 35%

(2) Price erosion started in 1993 with the entrance of Ogdan

(3) Decrease in prices took place in 1992 when market was opened, but since the implementation of the Directive, Manchester Airport estimates the prices have increased.

### 3. Critical analysis

Obviously, the Directive has at least partially<sup>10</sup> imposed its liberalizing economic point of view but the ground handling sector still faces great challenges in terms of legislation. Many airlines and independent companies do not complain only about the behavior of airports with regards to their dominant position and the allocation of shared heavy facilities, but also about local laws which sometimes are very restricting, and about imperfections of the Directive.

First, the separation of accounts between the airport and its ground handling activities is not sufficient according to some stakeholders. An organizational separation would be better because it would prevent from a conflict of interest. Indeed, airports are responsible for allocating facilities to ground handlers and are parts of the process distributing licenses<sup>11</sup>. It could lead to unfair competition.

On the other hand, airports are defending their ground handling activities for two reasons. First, it can be a profitable activity if it is well-managed. Then, airports are responsible for a minimum level of service which cannot be ensured if no ground handling is operated at the airport. It illustrates the complexity of this issue.

Then, licenses are granted for a period of 7 years which is considered too short especially by independent ground handlers. Their activities require big investments and the return on it seems to be difficult to reach within 7 years only. Since these entrepreneurs are still not sure if the grant of licenses is very fair, this situation may lead to a lack of entrepreneurship freedom.

Sometimes, local laws may be in conflict with European law. For example, the Schiphol Group faced big problems in allocating facilities as a Dutch law protects tenants: handlers need not give up their premises even if their handling volumes decline. Consequently, the development of new independent ground handlers is much more difficult and it distorts competition.

The same type of problems raised as ground handling dealt with social and labor issues. For example, Alitalia indicated that Article 14 in the Italian ground handling law, which relates to the transfer of staff, is the biggest ground handling problem in Italy<sup>12</sup>. Alitalia may be willing to expand its ground handling activities but it would be forced to hire the workers formerly employed by the airport.

Finally, we can indicate that the notion of centralized infrastructure (CI) is very controversial. It aims at limiting facilities at an airport by sharing some heavy equipment and buildings. However, airports fix prices and may give a discount on its CI to its own handling customers, abusing its dominant position.

---

<sup>10</sup> See exemption cases in Germany and Italy

<sup>11</sup> Even though the market is liberalized, a ground handling must be granted a license before it will be allowed to operate on the tarmac.

<sup>12</sup> See p98 of SH&E Limited report

## 4. Conclusion

The Directive is a step forward into a more liberalized market but we have shown that imperfections remain. Competition may be distorted not only by the historical and necessary involvement of airports in ground handling activities, but also several local factors. According to Regis Lacote, the necessity for ground handlers of owning a license is a factor tremendously limiting competition. Only 5 companies operates at CDG airport. This lack of competition allows ground handlers to negotiate higher prices. For example, ADP contracts have just been signed and prices increased by less than 10%. On the contrary, passenger handling activities do not require a license there. Hence, the number of competitors has increased tremendously over the past 5 years and prices have gone down by more than 30%.

# Appendix 1

## ADP ground handling equipment

Brand	Type	name of the GSE
MAK	MUS200/4	Air Star Unit
MAK	MUS200/4	Air Star Unit
Usimat	777-DC10	
Usimat	A319	Tow-bar
Usimat	757	Tow-bar
Usimat	757	Tow-bar
Usimat	737	Tow-bar
Usimat	737	Tow-bar
Usimat	EMB DH8	Tow-bar
Usimat	BAE146	Tow-bar
	A340/330	Tow-bar
Usimat	BAE146	Tow-bar
Usimat	B737	Tow-bar
Usimat	B777-DC10	Tow-bar
	B747	Tow-bar
Usimat	747	Tow-bar
Clyde	A320	Tow-bar
Dedienne Aerospace	B 737	Tow-bar
Usimat	EMB DH8	Tow-bar
Usimat	A319	Tow-bar
Usimat	CRJ	Tow-bar
Usimat	Embraer	Tow-bar
Usimat	B767	Tow-bar
Usimat	B767	Tow-bar
Usimat	B747	Tow-bar
Usimat	A330	Tow-bar
Usimat	A320	Tow-bar
Yale	GDP 20AF	Forklift
Yale	GDP 20AF	Forklift
Yale	GDP 20AF	Forklift
Yale	GDP 20AF	Forklift
Yale	GDP 20AF	Forklift
Yale	GDP 20AF	Forklift
Yale	GDP 20AF	Forklift
	ACE 804-340	Cooling Unit
	802-350	Cooling/heating Unit
Albret	ABS580 CANOPY	Steps
Albret	ABS580	Steps
FMC	UDS2 FMC + CANOPY	Steps
FMC	UDS2 FMC + CANOPY	Steps
	560 Sans C	Steps

Albret	ABS580 CANOPY	Steps
FMC	SSTEP-2 FMC	Steps
Albret	ABS580	Steps
Albret	ABS580 CANOPY	Steps
Albret	RV46 CANOPY	Steps
Albret	RV46	Steps
	ABT260	Steps
	ABT260	Steps
	ABT260	Steps
Albret	RV46	Steps
Albret	RV 40	Steps
ACE	140 KVA	GPU
Hobart	120 KVA CU24P5	GPU
Hobart	120 KVA CU24P5	GPU
ACE	140 KVA 4140	GPU
HOUCHIN	690-140 KVA	GPU
ACE	140 KVA	GPU
ACE	140 KVA	GPU
HOUCHIN	690-140 KVA	GPU
Hobart	90 KVA CU24P5	GPU
		GPU
FMC	Commander 30	Loader 14 T
Air Marrel	LAM3500 CCL35	Loader 3,5 T
Air Marrel	LAM3500 CCL35	Loader 3,5 T
Air Marrel	LAM7000B8	Loader 7 T
Air Marrel	LAM7000DPB8	Loader 7 T
Air Marrel	LAM7000DPB8	Loader 7 T
Air Marrel	LAM7000B8	Loader 7 T
Air Marrel	LAM7000B8	Loader 7 T
Lantis	818-218-161-152	Loader 7 T
Treppel	CHAMP 70W	Loader 7T Large
Air Marrel	LAM7000L8	Loader 7T Large
Treppel	CHAMP 70W	Loader 7T Large
Treppel	CHAMP 70W	Loader 7T Large
Treppel	CHAMP 70W	Loader 7T Large
Air Marrel	LAM7000DPL	Loader 7T Large
Treppel	CHAMP 70W	Loader 7T Large
Air Marrel	LAM7000L8	Loader 7T Large
Treppel	CHAMP 70W	Loader 7T Large
Air Marrel	LAM7000L8	Loader 7T Large
Tracma	TPX200S	Push-Back Tractor
Tracma	TMX400	Push-Back Tractor
SCHOPF	F396	Push-Back Tractor
Tracma	TMX400	Push-Back Tractor
Tracma	TMX100	Push-Back Tractor
Tracma	TMX100	Push-Back Tractor
Tracma	TMX400	Push-Back Tractor
Tracma	TMX500	Push-Back Tractor

Tracma	TMX 200	Push-Back Tractor
TCG	HC02	Dolly

Number of TCG Dollies:38

	PDM6.8	RQ Pallet Dollies
--	--------	-------------------

Number of RQ Pallet Dollies:64

	CD4+M 1/2A	RQ Porte Conteneur
--	------------	--------------------

Number of RQ Porte-conteneur: 316

ERMA	NBLE	Belt
------	------	------

Number of Belt: 18

Charlatte	T135	Tractor
-----------	------	---------

Number of T135 Tractor: 43

Charlatte	T140D	Tractor
Tracma	TMX20 D	Tractor
Mulag	COMET4	Tractor
Charlatte	T140D	Tractor
Charlatte	T140D	Tractor
Mulag	COMET3	Tractor
Charlatte	T140D	Tractor
Tracma	TMX20 D	Tractor
Charlatte	T140D	Tractor
Charlatte	T140D	Tractor
Charlatte	T140D	Tractor
Charlatte	T140D	Tractor
FMC	CPT7	Transporteur
FMC	CPT7	Transporteur
FMC	CPT7	Transporteur
TLD	TF7GR	Transporteur
FMC	CPT7	Transporteur
FMC	CPT7	Transporteur
AirMarrel	TAM7001	Transporteur
Air Marrel	TAM7001	Transporteur
TLD	TF7GR	Transporteur

**Appendix 2**  
**The Council Directive 96/67/EC**



## Table of figures

### References

Fig 1: [http://www.usimat-sermees.fr/gb/act\\_aero\\_towbar\\_gb\\_ok.html](http://www.usimat-sermees.fr/gb/act_aero_towbar_gb_ok.html)

Fig 2: [http://www.omegaaviation.com/fork\\_lifts\\_aviation\\_ground\\_support\\_equipment.html](http://www.omegaaviation.com/fork_lifts_aviation_ground_support_equipment.html)

Fig 3: <http://www.tld-gse.com/products/index.php?m=1&n=14>

Fig 4:  
<http://www.hobartgpu.com/Hobart%20Ground%20Power%20120%20kva%20400%20Hz%20Cummins.htm>

Fig 5: <http://www.airmarrel.com/>

Fig 6:  
[http://www.fmcairline.com/FMC/airline/\\_airline\\_product\\_display\\_action/1,11452,8,00.html?redir=1&SLogo=](http://www.fmcairline.com/FMC/airline/_airline_product_display_action/1,11452,8,00.html?redir=1&SLogo=)

Fig 7: Airport Design and Operation, written by Antonin Kazda and Robert E.Caves, p119

Fig 8: Airport Design and Operation, written by Antonin Kazda and Robert E.Caves, p118

Fig 16, 17, 18: SH&E Limited report

Table 1: *Airport Design and Operation*, written by Antonin Kazda and Robert E.Caves, p117

Table 2: *Airport Operation, Second Edition*, written by Norman Ashford, H.P. Martin  
Stanton & Clifton A.Moore

Table 3: SH&E Limited report (2002)  
*Study on the quality and efficiency of ground handling services at EU airports as a result of the implementation of Council Directive 96/67/EC*