Ground Handling

Kasper Ø. Helsted, Jens H. Stærmose, Christoffer C. Christensen, Christian H. Nielsen
Kasper F. Christensen, Anders L. Matthiassen & Josias Laugesen

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Participants:
    Kasper Østergaard Helsted
    Jens Hegner Stærmose
    Christoffer Carlé Christensen
    Christian Heider Nielsen
    Kasper Fuglsang Christensen
    Anders Lykke Matthiassen
    Josias Laugesen

Supervisor:
    Ramin Sadre

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Synopsis

Preface

Contents

Part I

Problem Analysis

1. Problem Analysis

1.1 Emergency Protocols

Occasionally unexpected emergencies occur, which the airport needs to respond to. A standard service manual for handling potential emergencies exists. When designing systems for airports it is relevant to know how they handle emergency landings: Which runways to shut down and prepare for the emergency, how to handle incoming and outgoing traffic and other airport services. The manual suggest following plan for an aircraft accident on the airport:

In general a lot of different organizations is involved in these emergencies, each with their own responsibilities. The airport traffic services includes following:

> Chapter 4 RESPONSIBILITY AND ROLE OF EACH AGENCY FOR EACH TYPE OF EMERGENCY
>
> 4.1 AIRCRAFT ACCIDENT ON THE AIRPORT 4.1.1 General The airport emergency plan shall be implemented immediately upon an aircraft accident occurring on the airport. For this type of emergency, responding agencies are expected to take action as described in 4.1.2 to 4.1.10 below. 4.1.2 Action by air traffic services 4.1.2.1 Initiate emergency response by using the crash alarm communication system (See Figure 8-1). 4.1.2.2 Notify the rescue and fire fighting service and provide information on the location of the accident, grid map reference and all other essential details, including time of the accident and type of aircraft. Subsequent notification may expand this information by providing details on the number of occupants, fuel on board, aircraft operator, and any dangerous goods on board, including quantity and location, if known. 4.1.2.3 Close the affected runway and minimize vehicle traffic on that runway to prevent disturbance of accident investigation evidence (See 4.1.5 2) f)). 4.1.2.4 If required, initiate communications to the police and security services, airport authority, and medical services in accordance with the procedure in the airport emergency plan. Provide the contacts with grid map reference, rendezvous point and/or staging area and airport entrance to be used. 4.1.2.5 Issue the following Notice to Airmen (NOTAM) immediately: "Airport rescue and fire fighting service protection unavailable until (time) or until further notice. All equipment committed to aircraft accident." 4.1.2.6 Verify by written checklist that the actions above were completed, indicating notification time(s) and name of person completing action.
>
> 4.3 FULL EMERGENCY 4.3.1 General The agencies involved in the airport emergency plan shall be alerted to "full emergency" status when it is known that an aircraft approaching the airport is, or is suspected to be, in such trouble that there is a possibility of an accident. 4.3.2 Action by air traffic services 4.3.2.1 Notify the airport rescue and fire fighting service to stand by at the predetermined ready positions applicable to the planned runway and provide as many of the following details as possible: a) type of aircraft; b) fuel on board; c) number of occupants, including special occupants — handicapped, immobilized, blind, deaf; d) nature of trouble; e) planned runway; f) estimated time of landing; g) aircraft operator, if appropriate; and h) any dangerous goods on board, including quantity and location, if known. 4.3.2.2 Initiate notification of the mutual aid fire department(s) and other appropriate organizations in accordance with the procedure prescribed in the airport emergency plan, providing, if necessary, the rendezvous point and airport entrance to be used.
>
> 4.4 LOCAL STANDBY 4.4.1 General The agencies involved in the airport

emergency plan shall be alerted to "local standby" status when an aircraft approaching the airport is known or is suspected to have developed some defect but the trouble is not such as would normally involve any serious difficulty in effecting a safe landing. 4.4.2 Action by air traffic services Notify the airport rescue and fire fighting service to stand by as requested by the pilot, or stand by as local airport agreements require at the predetermined ready positions applicable to the runway to be used. Provide as many of the following details as possible: a) type of aircraft; b) fuel on board; c) number of occupants, including special occupants — handicapped, immobilized, blind, deaf; d) nature of trouble; e) planned runway; f) estimated time of landing; g) aircraft operator, if appropriate; and h) any dangerous goods on board, including quantity and location, if known.

In conclusion, a runaway can be assigned to "full emergency" or "local standby" statuses, and when an accident occurs, the affected area is closed and traffic through the area is minimized. Furthermore, a signal of NOTAM is issued to notify that airport rescue and fire fighting services are all currently occupied.

-source Airport Services Manual, Part 7 by International Civil Aviation Organization (ICAO) Second Edition - 1991

1.2   Prices and Services

Fuel is an important part of Ground Handling, since it is required to make aircrafts fly. Aalborg Lufthavn has an agreement with the Shell corporation to get their fuel supply from them. The fuel that is used is called 100LL, and is a very common aircraft fuel, it is priced at DKK 19.85 pr. liter, which means that if you would have to fill up a Boeing 737-800, which can contain 26,020 liters, it would cost DKK 516,497 + the startup fee.

As described above you can see that there is a lot of money going around in an airport, even when you take just one airplane into account. the airplanes need to get filled up often, since a Boeing 737-800 uses 3,200 liters of fuel pr. hour when it is in the sky. This means that if you where to fly from Aalborg to Copehagen it would cost, just in terms of fuel, DKK 47,640.

1.3   Cargo

Luggage is loaded on the plane using tugs, which transport containers with luggage. The Boeing 747 has seats for 416 passengers (http://alturl.com/w7bfj) and can carry roughly 6,500 kg of luggage. 9,568 kg if plane would be entirely booked and every passenger had a 23 kg checked luggage, and in this estimate, the hand luggage is not taken into account. To transport such an amount of luggage, tied planning and careful transport is necessary in order to bring the luggage on the airplane in a timely fashion.

Novia and SAS Ground Handling are two ground handling companies that have the responsibility of loading luggage(http://alturl.com/y9jcc). If a passenger's luggage is, by mistake, sent with a wrong plane, the passenger can contact the airline company, and then they will talk with the ground handling company, that handled the luggage. In Aalborg Lufthavn, luggage is equipped with a RFID chip that allows the airport to track the luggage, so as to make it easier to locate lost luggage.

Luggage isn't the only thing transported besides passengers also freight is a big part of aerial transportation and is an industry that existed as long as passenger transportation. A larger and larger part of the world trade is beginning til be transported by air and although a lot of people have the notion that most freight is transported in airplanes for themselves but actually more than 60% of all freight is transported taken on in the passenger flights in the unused space by passenger luggage.

Besides the passenger flights an increasing proportion of freight is transported by integrated (where the airlines have their own equipment) or express (don't know?) carriers by a so-called door-to-door service, where the company transport the goods all the way. Since the companies that transport the freight is in charge of all the transportation, both in air and on ground, the tracking of freight is a lot wasier and the direct involvement of the costumer is kept to a minimum. There services mostly take shipments less than 100 kg. This service help the larger companies to transport freight a lot easier and intercontinental. For instance Fedex delivers 3.2 million packages per day in more than 220 contries thought 50,000 drop-off locations, using 671 aircraft, 41,000 vans and 138,000 employees (2005). Many integrators construct and operate their own terminal where their goods arrive and is checked, packed, documented, transported to the apron and so on by their own system. Their traffic is normally very peaky and the dwell time

is normally shorter. Their goods normally consists of packages smaller than 30kg and courier mail. At these terminals the standards are normally:

- Consignments available for collection, examination or transhipment three hours after arrival

- Cleared consignments available within 15 minutes of consignee arriving at import collection point

- Customers to wait not more than 30 minutes after arrival for collection at truck dock

- Cargo reception to be complete within 30 minutes of arrival at truck dock.

("It is quite common for integrators to use space on combination carriers and vice-versa. There are also airlines that specialise in heavy lift, using small fleets of unique aircraft like the AN 124 or the Mil 10 helicopter.") WTF?

When cargo arrives at the airport it normally arrives at a terminal, it is normally transported via electrical tugs from the trucks into the terminal in carts carrying bulk freight, pallets or containers. The freight is now taken though a sort process that deposits the goods directly at the stuffing platforms or they are again taken by conveyor (Packages up to a maximum of 30 kg are put into trays on the conveyers) or fork lift to the platform. Unless there is a full container for one distanation the cargo is rearranged at these platforms by destination in new containers called ULDs, wich stands for Unit Load Device and is normally a pallet or container, specific for the aircraft type it needs to be transported on.

This also applies for freight arrived from air from another airplane where the cargo is in transit in the current airport. The only difference beeing that this cargo arrives from the airside, not landside. This process of rearraging is entirely manual no matter how mechanized the terminal is (will be described shortly) and is preferably done on height-adjustable platforms that can indicate the weight and sometimes the stability of the ULD. These information is very important when you load the aircraft to ensure a stable aircraft in balance.

There are five different tasks performed in ther terminal:

- Conversion between modes of transport

- Sorting, including breaking down loads from originators and consolidating for destinations

- Storage, and facilitating government inspection

- Movement of goods from landside to airside and vice-versa, or from aircraft to aircraft

- Documentation: submission, completion, transmission.

Getting these five tasks just right and performed smooth and effective can reduce the mishandling rate from 1 : 20 to 1 : 26,000.

Normally the terminals use the storage area to store freight which is awating clearance but it is also used for freight before it is rearanged or outbound freight awating consolidation, stuffing or simply waiting for its departure time and transhipments. This pickup can be a matter of an hour or two but can in some countries be several weeks if they have no restrictions since this then is free storage for the companies. This in developed worlds is normally not the chase where the time is normally 20 hours for export, 40 hours for import and 32 hours for transhipment.

In total on order takes about 6 days from sender to receiver where the freight normally spends 90% of it's time on the ground whereas 12% is transport time and the rest is storage where the freight is waiting on documentation due to lack of recources or information, or inaccurate delivery instructions, or problems with customs clearance. This stands very much in contrast to the inside of the integrators' terminal where freight normally arrives just before it is time to be shiped by plane and already have been cleared and sorted.

All freight can at all times be forced to be inspected by government agencies for contraband, drugs, illegal immigration, weapons and so on.

In different countries they have different standard for labor and they level of automation in the terminal is therefore different in each country. Generally there are three different level of mechanization.

- Manual: manpower plus fork lift trucks

- Semi-mechanised: roller beds or conveyors

- Fully mechanised: Elevating Transfer Vehicles (ETV), Automatic Storage and Retrieval Systems, Transfer vehicles.

("A semi-mechanised system possibly have a conveyor systems and powered flat roller conveyors where the rollers are chain-driven from the previous one. They will also have reorienting and transfer dock beds: some have wheels that right angles rise up between the rollers, or powered ball decks, or heliroll rotation tables where the different quadrants are powered with a joystick.") SOMEBODY??

The pro'es with a manual and mostly laubour controlled system is that it is flexible in peak-hours and can easily adjust but the cons is of cause that is is more expensive over time. On te other hand a fully mechanised system functions best when a lot of cargo flows though the terminal and all of this is containerised and the machines can be serviced very fast. Of cause the whole system can still break down if a ETV (Elevating Transfer Vehicles, the vehicles that organize multilevel storageup to seven meters) breaks down. Therefore for instance British Airways, also uses lifts and lowered roller conveyors at its multi-level World Cargo Centre at Heathrow, in chase of a breakdown.

Normally freight is now transported to the flights at the so-called aprons which is the area where the flight is serviced by the Ground Handlers normally via trucks but some airports also uses rail.

This freight and luggage is normally transported in ULDs via roller-bed dollys (Flat carts made to "give" the ULDs wheels) to the aircraft and then lifted into the aircraft either from the side or the front via High-loader vehicles (A truck specialized to raize and move the ULDs inside the aircraft). The ULD can now be organized inside the aircraft on roller beds (a small track-like system consisting of small cylindrical "wheels" where the ULD can be pushed. The cargo needs to be loaded in the right order to achieve balance. The bulk cargo (cargo that is not containerized or on pallets), which have been transported to the flight in carts, can now be loaded into the flight via self powered conveyer belts. Therefore is it very important for the airport to know if the cargo will arrive in bulks, on pallets or on small or ULDs and if it needs transportation from the terminal to the apron or the company will transport it on trucks granted access to the aprons.

The area, both inside and outside the flight, need to be lit up enough for the personnel to read

document, stables and placards but especially for safety reasons so that the personnel can see and not make dangerous mistakes or get hit by moving objects but also not too bright so the flight crew cannot maneuver the aircraft.

This equipment is very expensive, especially the High-loader and needs specialized drivers, therefore the companies often share this equipment.

There is a lot of movement between the cargo and passenger aprons an they should therefore be placed close to each other.

Research:

- How much Freight is normally transported?

- How expensive is it to have you airplane in the airport in fees? ("Time in flight and in transit is most important, a saving of one hour perhaps being worth $1000 in airport fees. (2005)")

Knowledge (2005):

- The trends also tend to reduce the ratio of value to weight, but the aircraft loads are still generally more limited by volumetric capacity than by weight limits.

1.4 Stakeholders

Personal

- Security

- Flight controllers

- Emergency crew

- Clean up crew http://alturl.com/3onjh

- Catering staff

- Mechanics

- Flight Crew

- Baggage handlers

- Boarding Personal

The Airport

- Administrators

The Airline companies

- SAS, Lufthansa, Norwegian, etc...

Passengers

- Check-in

- Delays

1.5 Organization

Supply chain(Fuel, Water, Food) Infrastructure(Taxiing, Gates)

1.6 Technology

Computers Smartphones GPS Internet(Servers) Databaes(Arrivals,

1.7 Existing Solutions

(FILL IN LATER!)

1.8 Solutions

Make an information system to achieve:

- Optimized infrastructure(Taxiing, Passengers, Fuel)

- Prices(Total Price for ground handling services)

- Servers bases solution, accessible on various platforms/interfaces

- Passenger handling(Baggage Boarding, Food, Water)

1.9 Airplane Mechanic

The airplane mechanic has a very important job in the airport, their job is to repair the airplanes. It's therefore important that these working crews can acess the airplane that needs repairing quick and easy, and know where they needs to go, so the airplane can get flying again as quick as possible. It is also important that they does their job as good as possible, since they are responsible for safety of the plane, as every part needs to be maintained correctly.

In the north and the baltic countries, the leading airplain mechanic company regarding technical airplane maintenance is SAS Tech.

If it would be possible for airplane mechanics to know excactely where to go by viewing it on a smartphone, PDA or other protable device, the mechanics would be able to be more productive, as they would know instantly where they where needed for their next task.

Boeing has released an app to help the mechanics get important things like airplane manuels, and serial numbers for specific parts. If they would be able to do this with every airplane, or every airplane at Aalborg Airport, it would help the mechanics tremendously as they would be able to identify the parts they needed much quicker, and therefore the maintenance of an airplane would be quicker. By using an app you would also be able to find earlier maintanence records, meaning that if another mechanic may have made a mistake, you would be able to identify it much quicker.

A downside to making an app like boing, could be the obvious problem of grease. If the Mechanics are supposed to use a tablet, PDA or smartphones, wouldn't they need to use a lot of time to clean their hands in between using the device, and would this really make the repairing of the aircraft faster?

Other suggestions for apps that could help mechanics do their job faster an better include:

1.10 Problem Statement

Ground handling companies often hire low-paid workers, who work in an environment where they are exposed to congestion, stress, noise, jet-blast, extremes of weather and sometimes low visibility conditions. Stress is a very big part of the work in an airport, especially for the ground handlers, since airlines do not make money while the aircraft is not in the air; hence the ground handlers are very pressed on time. In many places it is also the workers who are responsible for delays and in case of a delay can be deducted in salary.

When a worker is stressed he is more likely to make mistakes, which could lead to serious accidents. These accidents can first and foremost become dangerous for the workers because they can be hurt as a result of an accident. A survey made by ACI[citation needed] in 2004 showed that out of 15,119,020 aircraft movements 3,233 had accidents, concluding that 0.214% of all turnovers had accidents.

Accidents do not only lead to dangerous situations for the workers, but can also become very expensive for the companies; first of all because of the cost of the repair, but also because the aeroplane will then have to spend more time on the ground.

1.10.1 Problem Formulation

Most of the delays and errors that happen to aeroplanes are caused by the ground handlers, who service the planes. Is it possible to reduce stressfactors and optimize performance for ground handlers, by making an information system, that can dynamically manage ground handlers' tasks throughout the day?

1.11   Airtraffic from Aalborg Airport

By 2013 there where more then 6.000 official airline flights from Aalborg airport, of them, the most common types of aircraft are shown in the table below:

Aircraft	Flights
BOEING 737-800	2919
AIRBUS A-320	2544
FAIRCHILD DORNIER 328	1080
EMBRAER ERJ 190-100	732
AIRBUS A-321	725
FOKKER 70	723
SAAB 2000	370

Aalborg Airport, also have a privat airtaxi service called North Flying, which can fly private person [http://www.aal.dk/b2b/north-flying/#.UveuHvldVYU].

2.500 cargo flights are made daily [http://www.aal.dk/b2b/cargo-fragt/#.UveuFfldVYU].

Part II

Product Development