FRANKFURT UNIVERSITY OF APPLIED SCIENCES

MBA in Aviation Management

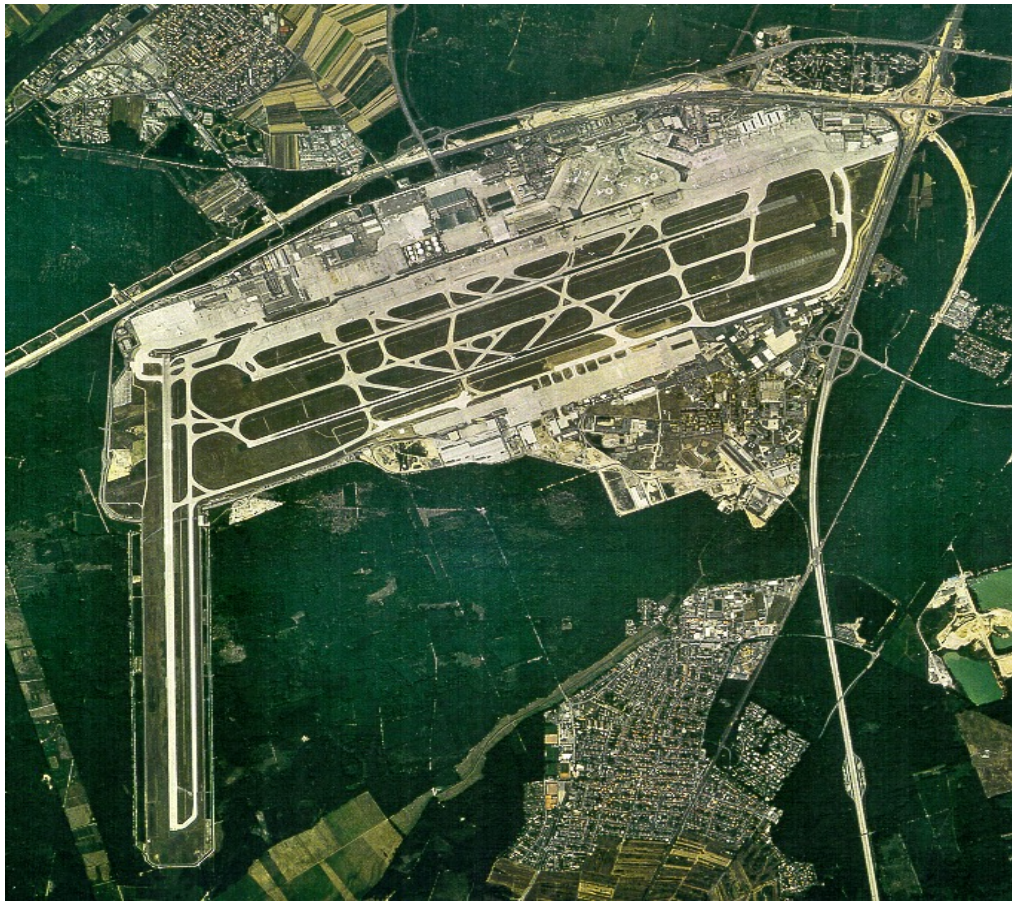
Part 6:
Next Generation ATM System

Frankfurt, 2023, January

Knut R. WALTHER

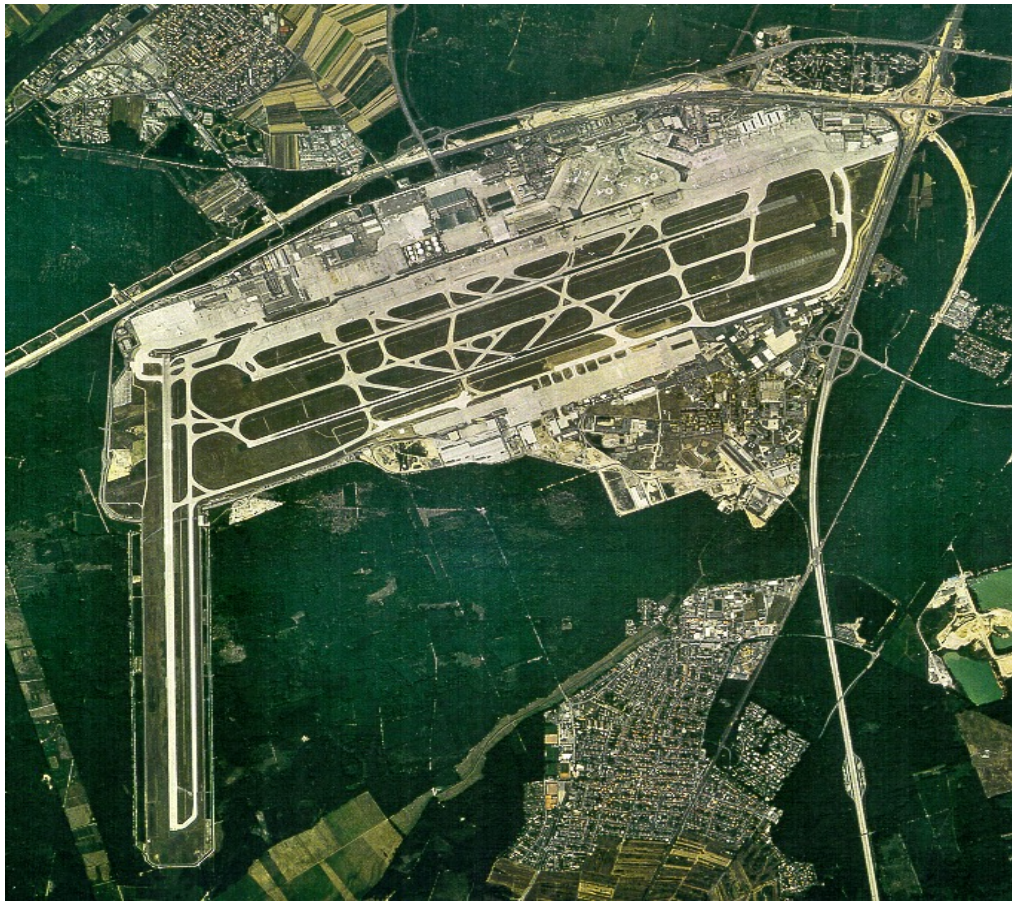
Frankfurt Airport
Traffic Figures (2006)

Movements p.a.		489.406
Peak Day	15.09.	1.470
Passengers p.a.		52,8 Mio.
Peak Day	29.09.	181.794
Cargo p.a. (metric tons)		2,06 Mio.t
Peak Day	17.09.	8.477 t
Employees		approx. 70.000

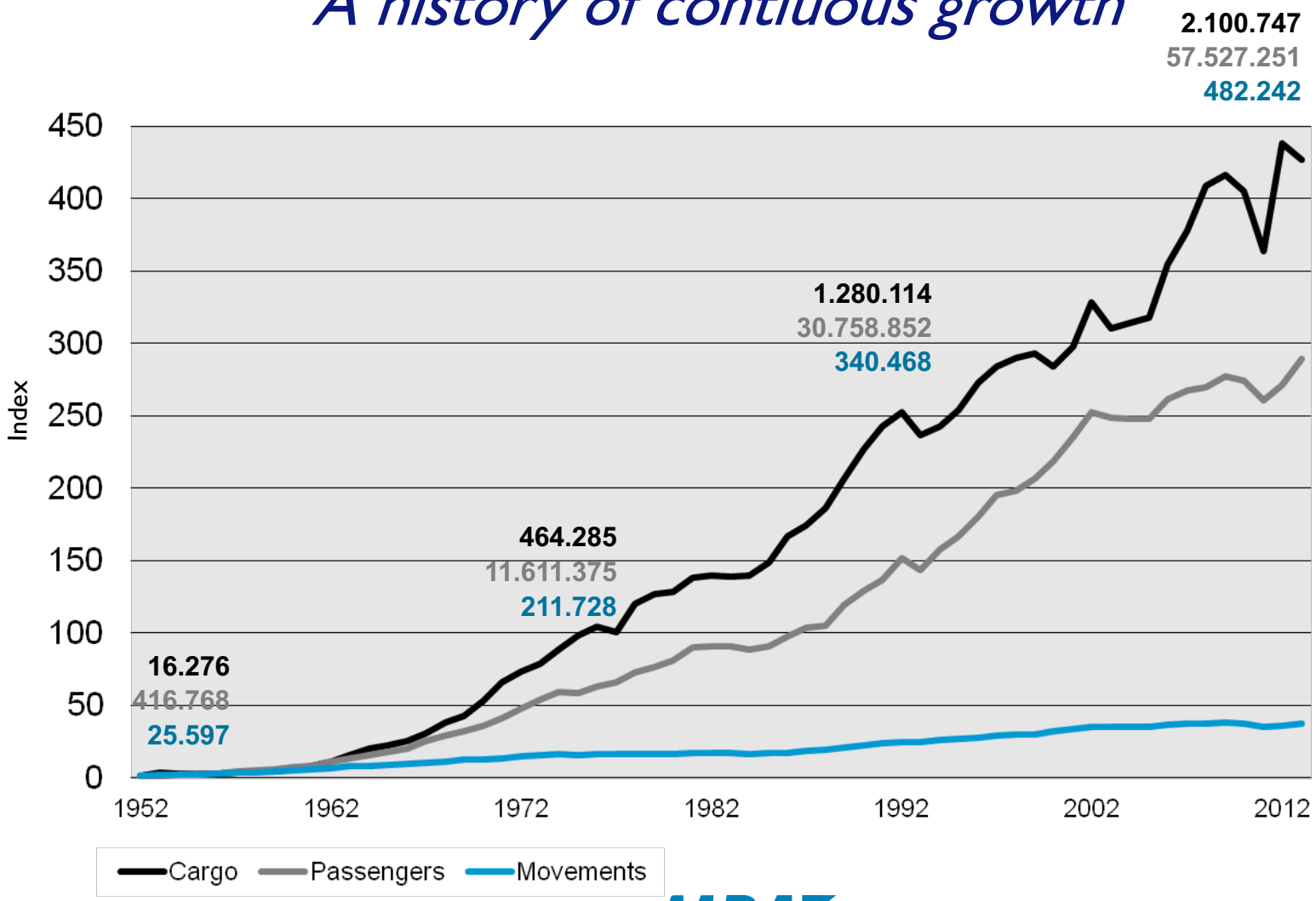


Frankfurt Airport
Traffic Figures (2013)

Movements p.a.		472.692
Peak Day	11.09.	1.500
Passengers p.a.		58.042.554
Peak Day	18.08.	199.469
Cargo p.a. (metric tons)		2,048.729 t
Peak Day	01.12.	8.458 t
Employees		approx. 78.000



Frankfurt Airport
A history of contiuous growth



MBA AVIATION MANAGEMENT

Examples for innovation drivers at Fraport

Wettbewerbsdruck:

Dem Druck, der vor allem durch Wettbewerber aus dem Mittleren und Nahen Osten ausgeht, kann Fraport nur mit steigender Qualität und Effizienz (z.B. Pünktlichkeit) entgegenwirken

Kostendruck:

Steigende Lohn-, Transport- und Betriebskosten bei der Abwicklung des Flugverkehrs verlangen nach innovativen Lösungen

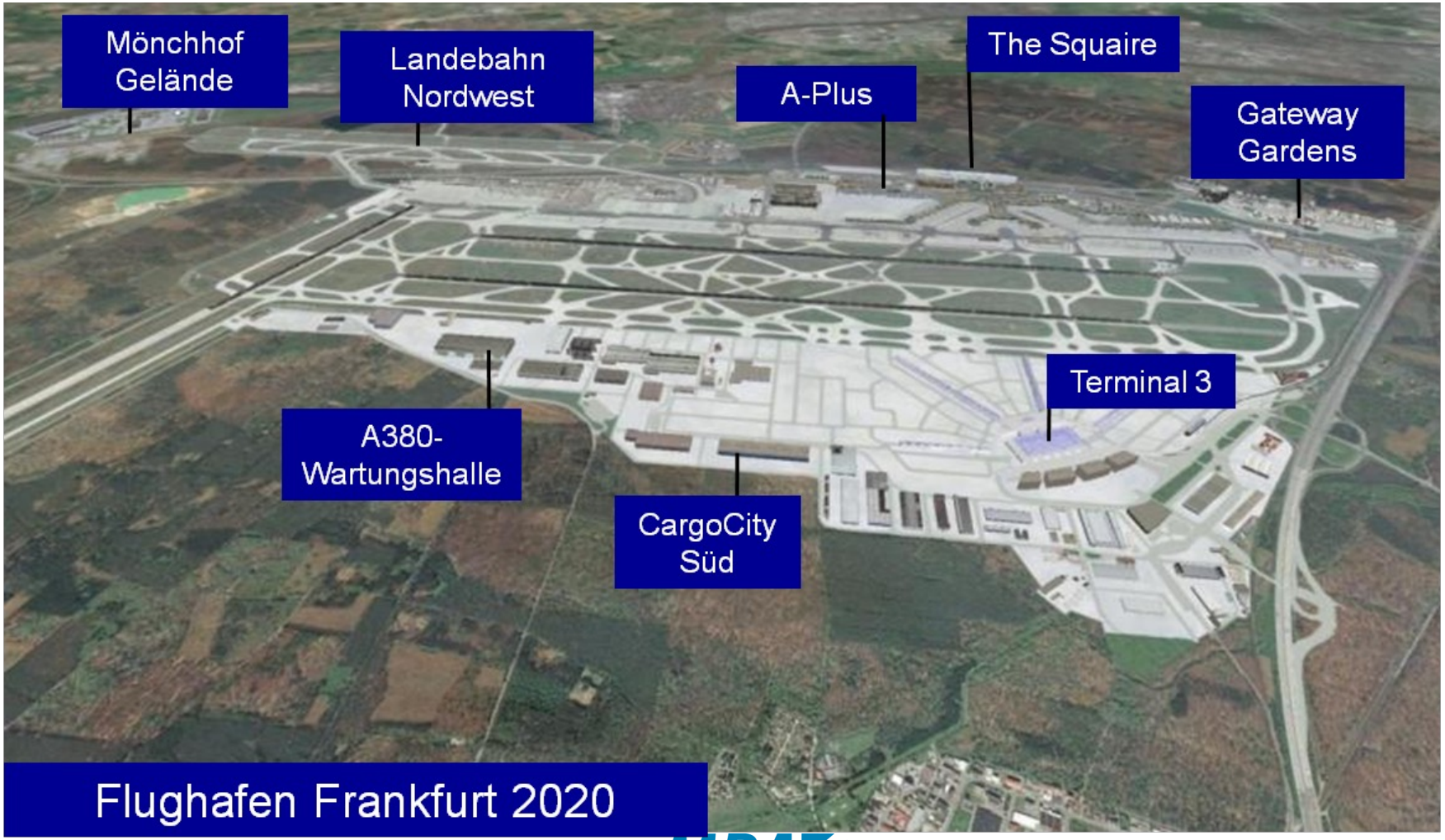
Komplexe Prozesse:

Die komplexen Prozesse bei der Abfertigung des steigenden Verkehrs auf relativ engem Raum benötigen innovatives Prozessmanagement und einen höheren Grad an Automatisierung

Behördliche Auflagen:

Behördliche Auflagen, vor allem in den Bereichen Sicherheit und Umwelt verlangen neue Prozesse und Technologien

„Airport City“ FRA: Platform for meshed Business models



Growth due to new infrastructure - Runway Northwest and Terminal 3

2015

⇨ Very limited Chance for NEW infrastructure within Europe!

2023

Mönchhof: Largest homogenious Logistic-location within Rhine-Main Region

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Gateway Gardens: International Business Location with successfactor

2016

2021

Cargo City Growth

Frankfurt Airport
Capacity Enhancement

1. Optimisation:

Frankfurt has reached its capacity limit, further optimisation is needed, with new technology and procedures 520.000 movements pa. could be achieved.

2. Airport Expansion:

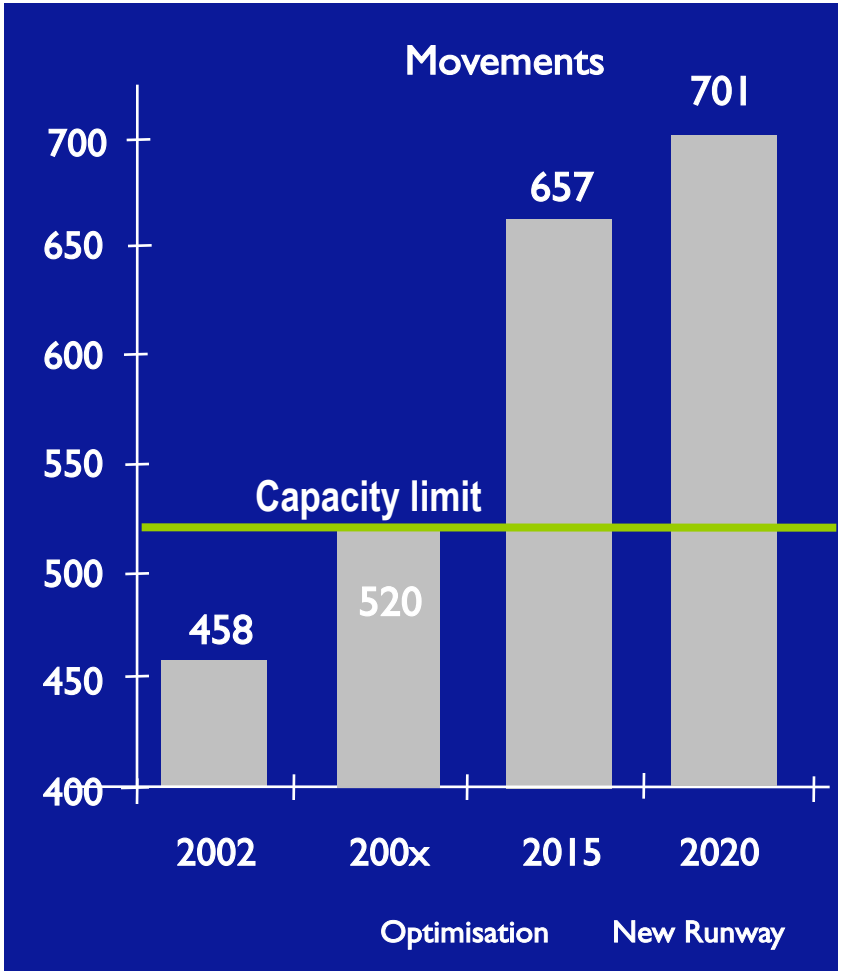
Prognosis for

2015:		**2020:**
82.3 Mio.	passengers	88.3 Mio.
657,000	movements	701,000
2.7 Mio. T	cargo	3.16 Mio. t

➢Construction of a fourth runway

2,800 meters length
Bi-directional use
Precision Approaches only

➢Construction of a third Terminal, completion in several steps starting in 2015



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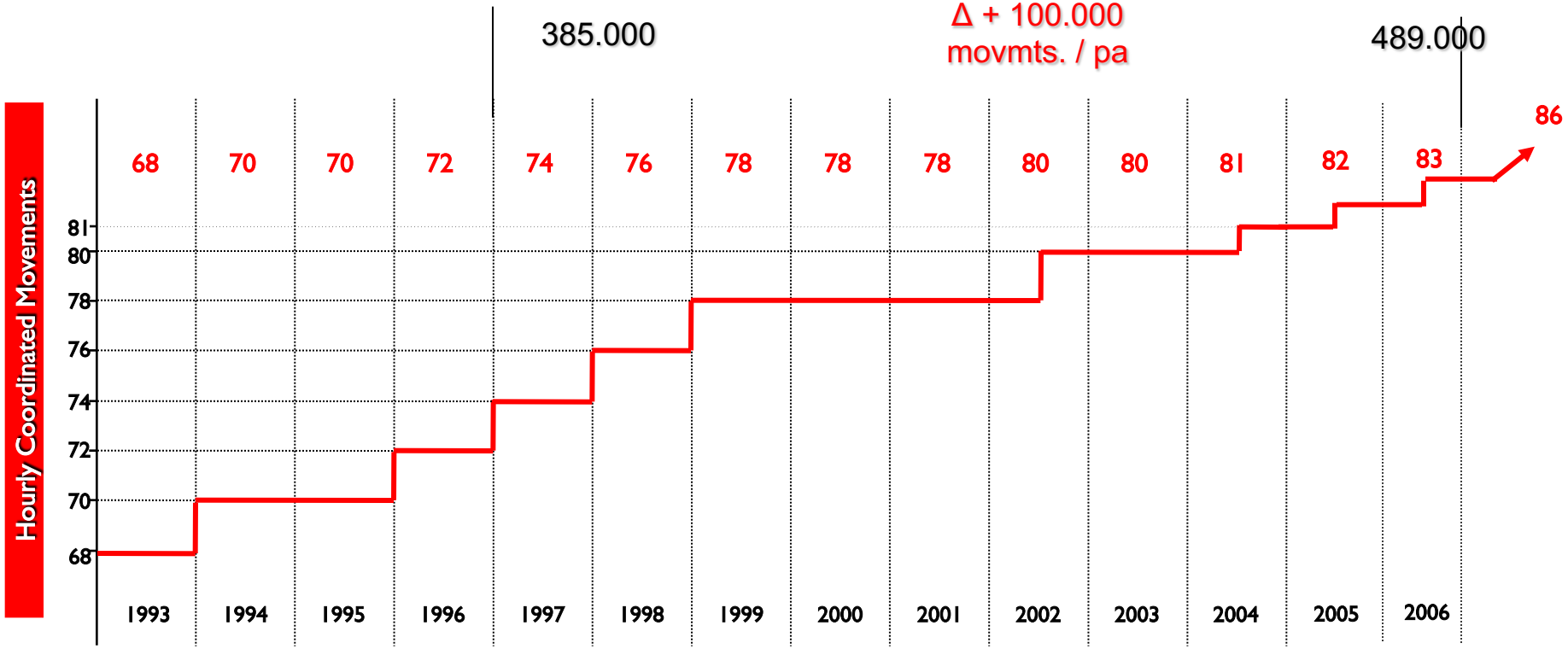
Frankfurt Airport
Capacity Enhancement

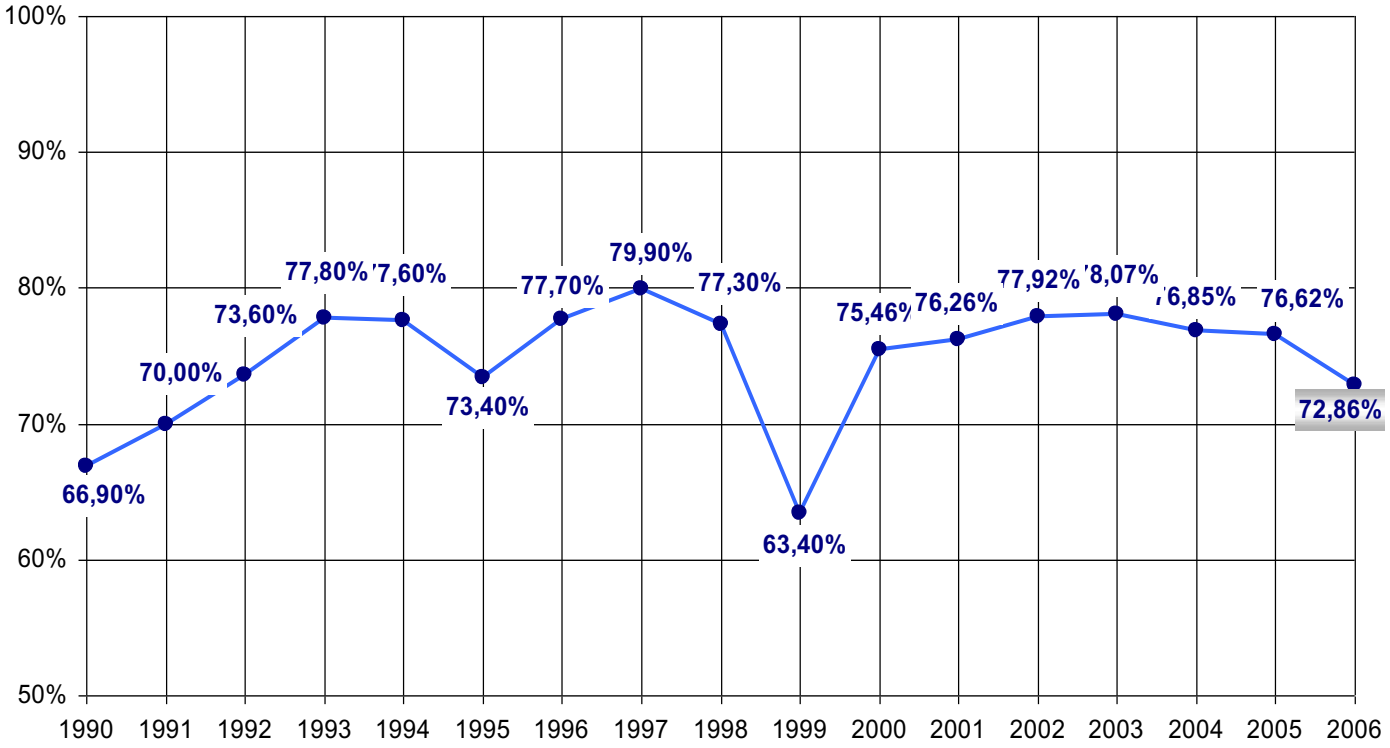
Frankfurt Airport has increased significantly its capacity in the past ten years.
This was achieved by new ATC technologies and ATC / airport procedures.



Development of hourly declared capacity in Frankfurt (1993 – 2006)

Frankfurt Airport
Capacity Enhancement - Punctuality

Frankfurt is one of the leading hubs in Europe concerning punctuality, with the integration of new ATC technology and ATC / airport procedures Frankfurt Airport is operating the increasing traffic volume with high punctuality.



Development of Punctuality in Frankfurt (1990 – 2006)

Frankfurt Airport
Capacity Enhancement

The airport expansion requires the adaptation of the existing systems to the new runway usage and the integration of totally new systems.

Airports
The role of the airport

- Airports are the exclusive access-points to air-transportation.
  Airports are the groundbasis for aircraft- and airlines-operations.
- The airport is the connecting-link in the air-to-air-process. From the point-of-view of the passenger the air-to-air-process is only one critical element of the gate-to-gate-process.
- Airports face the following key challenges:
  - Airports need additional capacity. Where a physical expansion of the airport is not feasable, additional capacity must be gained from the permanent optimisation of the procedures. This is espacially valid for the integration into the ATM system.
  - Airports are critical locations in the population environment. The most critical issue in this regard is aircraft-noise. ATM procedures of the future must better consider active noise-reduction procedures. Otherwise airport capacity will be limited due to environmental restrictions.
  - Airports must operate more cost-effective.

Frankfurt Airport
System Development

Traffic Management system will play an important role in the Air-to-Air Process.

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Frankfurt Airport
System for Traffic Management

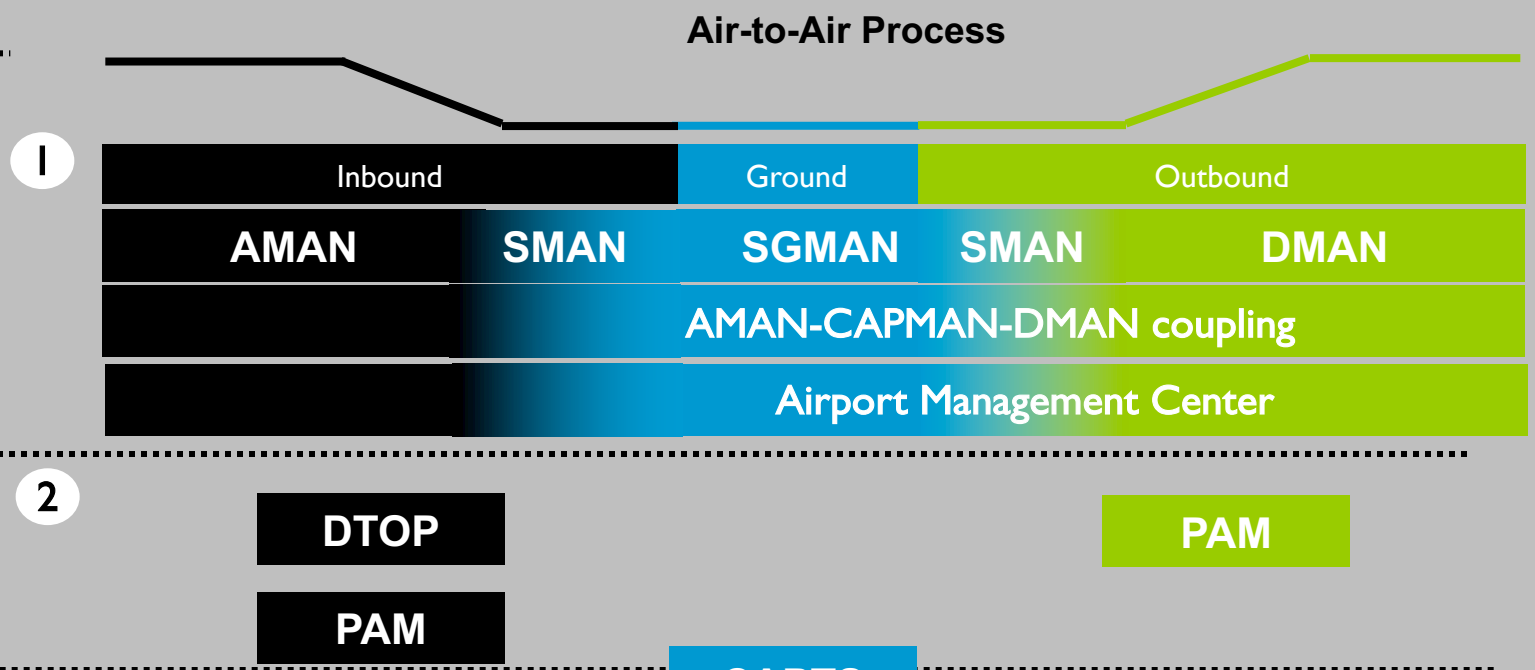
New developed systems will support ATC and the aerodrome operator in the field of tactical planning, separation reduction and taxi guidance and control.

Concepts

Air traffic control systems

Separation reduction

Taxiing



AVIATION MANAGEMENT

Frankfurt Airport
Aviation related research

Due to the need for capacity / punctuality enhancement systems Fraport is active participating in different EU and national research programs.

Areas of research	Research Projects			Systems / Products in FRA
Navigation and landing aids	MLS	NEAN	DGPS	•ETNA
Detection and Surface Movement Guidance and Control	VISION	ISMAEL		•CAPTS •PAM
Wake-Vortex related research	WAKENET	LUFO III		•WVWS •HALS/DTOP
Process optimisation & simulation	OPTAS	A-CDM	KATM	•DMAN •CAPMAN •ATAMAN
Turnaround Process and ground services	RFID	Pilot Project Loading Robot		

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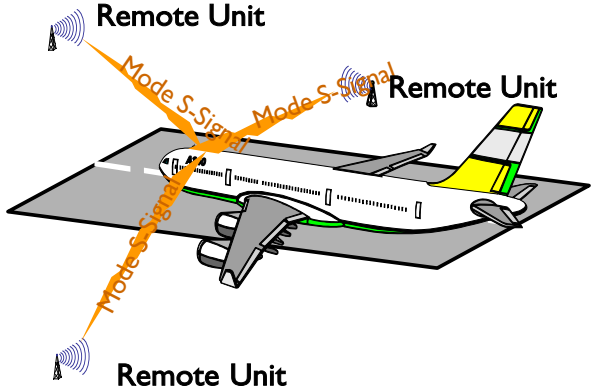
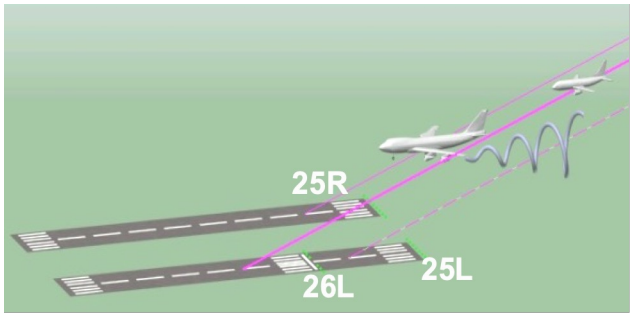
Frankfurt Airport
Aviation related Research

Multilateration Principle



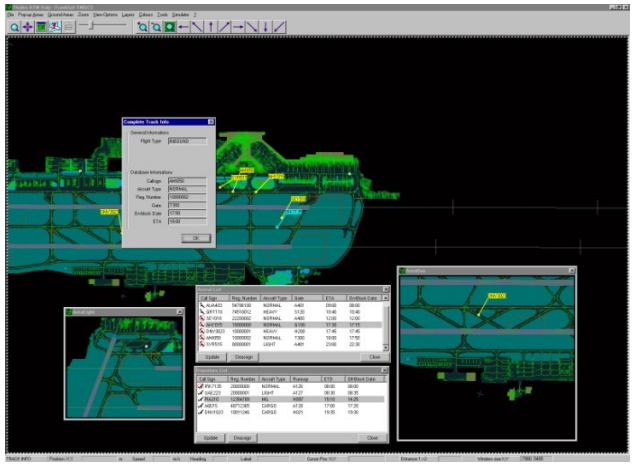
HALS-Principle



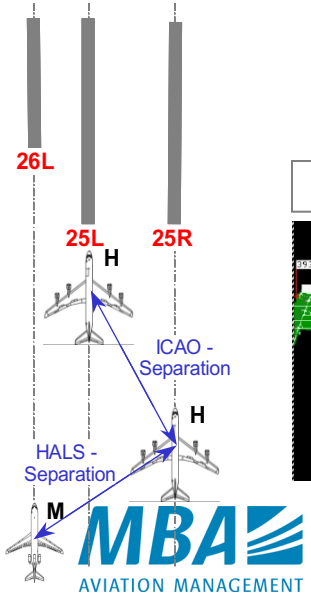
ETNA Vehicle Navigation

ETNA Onboard Display

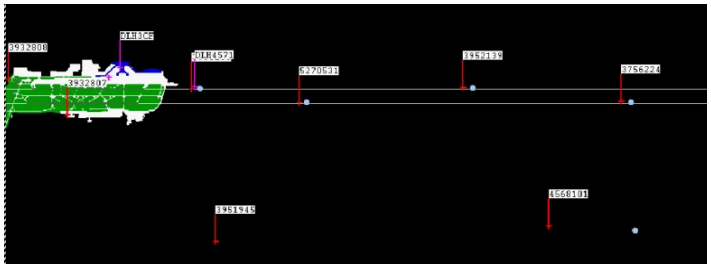
TACSYS-Display



DTOP-Principle



Approach surveillance by PAM



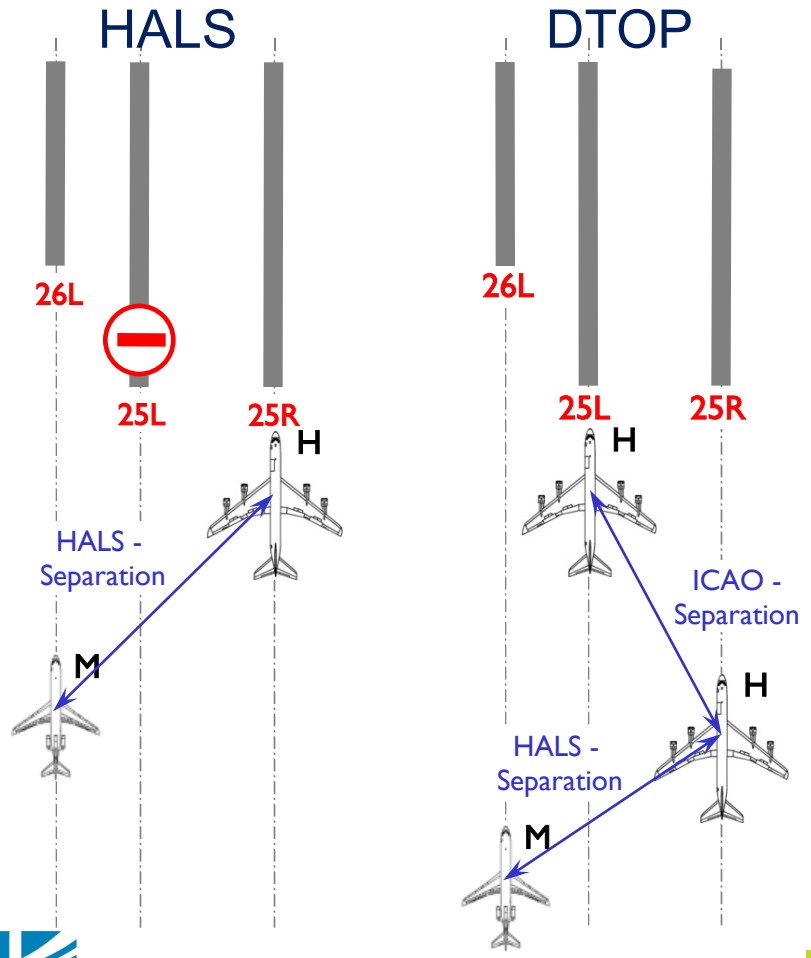
Frankfurt Airport
System and Procedure Development

➢ **DTOP** (Dual Threshold Operation)

Description

- The concept and design of HALS/DTOP was generally developed for operating the two landing thresholds simultaneously
- HALS is one of the possible ways to use the second displaced landing threshold on the runway. HALS allows the optimal exploitation of a higher flight path for wake vortex separation reduction
- Within the DTOP concept the both regular and displaced thresholds on the southern runway 25L/07R are used simultaneously
- Study: Separation reduction - A380 followed by medium aircraft.
- Status: research and development project, not in daily operation

Operation mode



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Frankfurt Airport
System and Procedure Development

➢Precision Approach Monitoring (PAM)

ATS – Along Track Separation (intended by Fraport)

Procedure:
- Closely spaced parallel runways with spacing below 1035 m
- Approach without No Transgression Zone (NTZ) with a reduced diagonal separation of down to 1,5 NM

Advantage:
- Possible for all visual conditions down to ILS, CAT I minima

Disadvantage:
- Procedure is not yet in operation and certified at any airport

Status:
- The installation of a PAM-system at Frankfurt airport by DFS is planned after ~ 2008...

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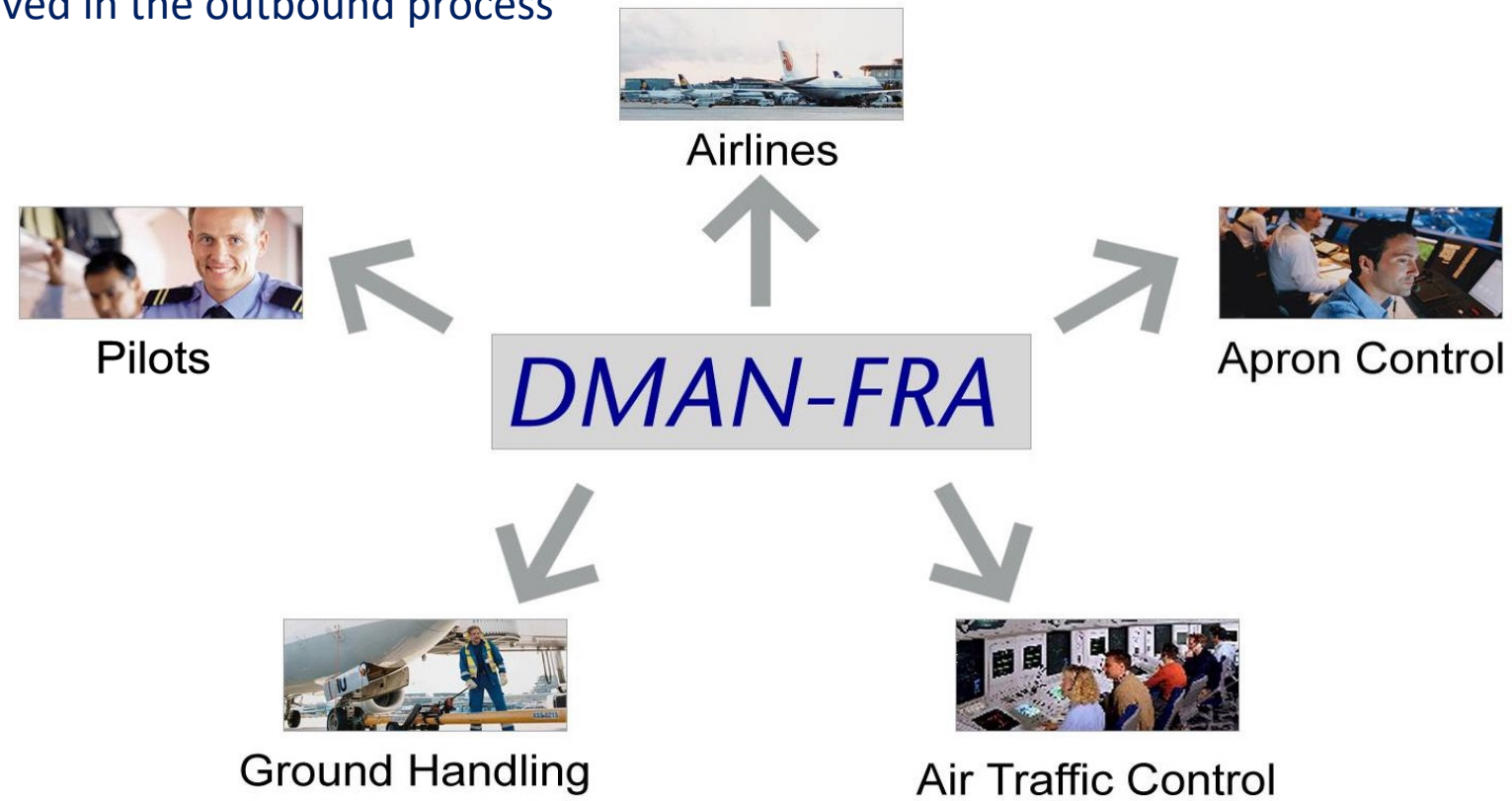
Frankfurt Airport
System and Procedure Development

➢DMAN – Departure Management System

Who Profits from the Departure Management System?

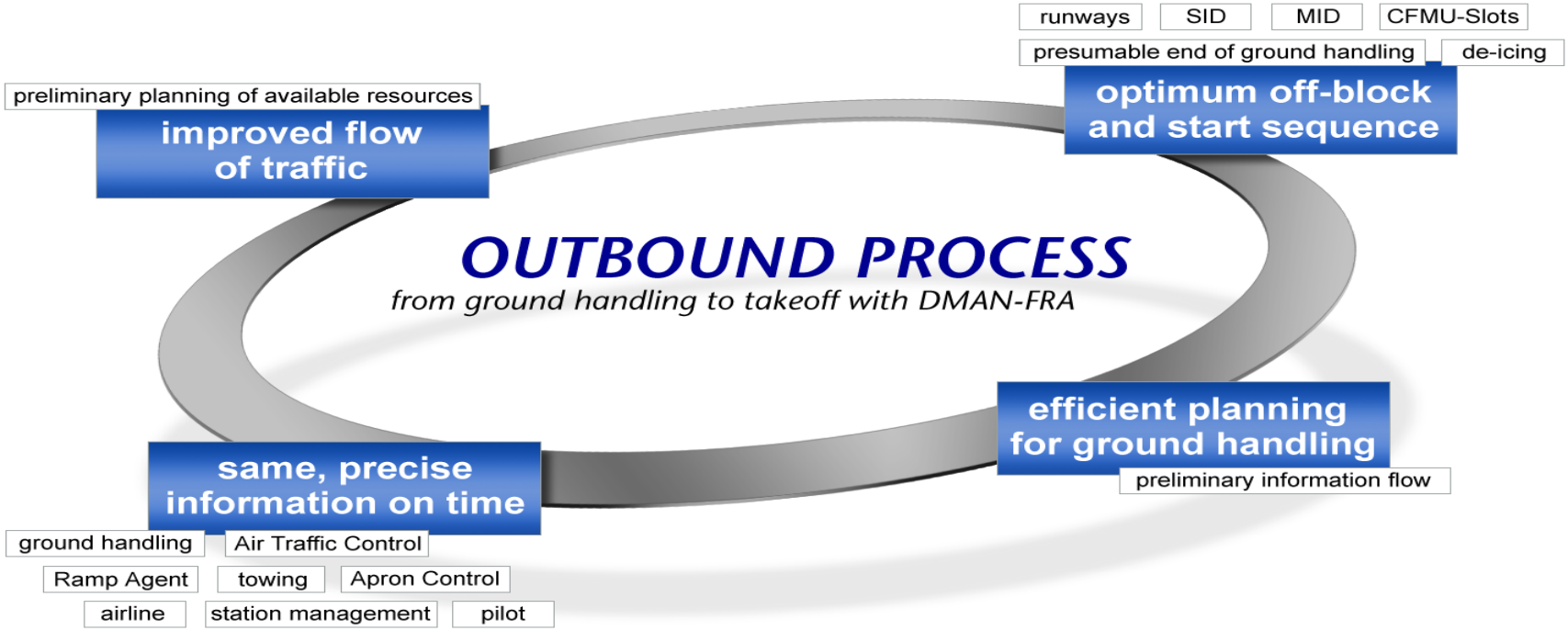
- Integration of the interests of all involved companies and organizational units involved in the outbound process



Frankfurt Airport
System and Procedure Development

➢DMAN – Departure Management System

- DMAN-FRA integrates the interests of all parties involved in the outboundprocess and effects more planning stability and process quality
- Status: DMAN will be operational at Frankfurt Airport beginning March 2007



MBA AVIATION MANAGEMENT

Frankfurt Airport
System and Procedure Development

➢CAPMAN – Air traffic planning system based on traffic volume

Functionality

- Analysis and forecast of the airport airside capacity (departures and landings) per hour based on conditions like weather, infrastructure availability and traffic demand
- Determines and estimates the accumulated departure and landing demand per hour
- Determines and estimates the achievable and expected IATA punctuality rate
- Transfers the available capacity to ATAMAN and to the air traffic planning and control systems of the German ATC (Stage 2 and Stage 3)
- Status:Stage 1: validation for operational use at Fraport
  - Stage 2/3: research and development project

Frankfurt Airport
System and Procedure Development

➢ATAMAN – Air traffic planning system based on single flight visits

Functionality

- Analysis and forecast of every single flight visits
- Determines for each arrival the optimal runway based on capacity and punctuality and for each departure the optimal runway based on capacity and taxiing costs.
- Estimates the punctuality for each flight and the punctuality of the Air-to-Air process
- Determines the delay of the flight
- Determines goal-times to increase the arrival and departure punctuality and transmits them to the air traffic planning department of German ATC.
- Status: research and development project, not in daily operation

Frankfurt Airport
Conclusion

- The traffic development of Frankfurt airport is the result of the development and usage of new ATC / airport systems and procedures. Systems and procedures will also in future increase safety and capacity at Frankfurt Airport.

- New systems and procedures have to be developed, especially in the field of Wake Vortices prediction.

- Frankfurt Airport plays an active role in the aviation research community. We expect new systems and procedures derived from R & D – Programs in the future.

- Capacity and punctuality enhancement can only be achieved when all the aviation parties (airport, ATC and airlines) are working closely together

Thank You for Your Attention!