# **Total Airport Management**

A holistic approach towards airport operations optimisation

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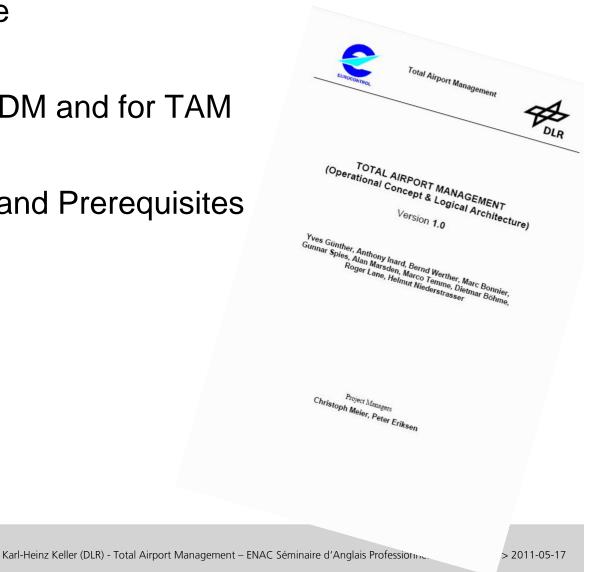


#### **Overview**

- → DLR at a Glance
- Motivation for CDM and for TAM
- → TAM Approach and Prerequisites
- → TAM Benefits

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#### DLR – at a Glance

6900 employees across33 institutes and facilities at

■ 13 sites in Germany

Offices in Brussels, Paris and Washington.

#### **Research Areas**

- → Aeronautics
- ✓ Space Research and Technology
- → Transport
- → Energy





#### Aeronautics Portfolio Air Transport Systems

System evaluation and optimisation

#### Aircraft

Concept design/evaluation [Virtual Aircraft (Digital-X)]

	Airframe	Systems	Propulsion
	Materials and structures	Flight systems	Materials and
Strategic Research Agenda	Physics of flight	Cabins	construction techniques
		Human-machine interface	Flow machines
			Combustion and
Including: efficiency environment security			emissions

#### ATM and airport research

Arrivals and departure management

Flight guidance automation

Weather forecasting and monitoring

Taxiing management

Intermodal transport

Wake vortices

#### **Tools and processes**

Numerical simulation, experimental simulation, airborne simulation

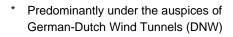


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#### **Facilities – Aeronautics**

- ✓ Research aircraft
- Cockpit simulators
- Tower simulator
- ➤ Airport simulator
- Compressor, combustion chamber and turbine test beds
- ➤ Autoclaves
- Material and structural test facilities
- ✓ Wind tunnels\*







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#### **Challenges for DLR - Institute of Flight Guidance**

# The Air Transport System of the future will be characterized by

- → Growing traffic
- → Eco friendliness
- Increased Efficiency
- → Safety and Security

# Optimizing Air Traffic Management (ATM) and airport processes by

- ➤ New ATM- and Airport-Concepts
- → Air-Ground-Integration
- ✓ Airport-Performance-Modeling





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#### **DLR-Institute of Flight Guidance – Organisation**

Structure	Resources	Infrastructure	Networks
Departments Air Transportation Controller Assistance Pilot Assistance Pilot Assistance ATM Simulation Operations Control Human Factors Mgmt. Services Business Manager	<ul> <li>~ 140 employees:</li> <li>~ 70 Scientists</li> <li>1 Guest Scientists</li> <li>8 PhD Students</li> <li>10 Diploma Students</li> <li>5 Trainees</li> </ul>	Fast-Time Simulation Human-in-the- Loop-Simulation Ground Operations Cockpit Data Links Test Aircraft Research Airport A-SMGCS Test GBAS	AT-One DLR Institutes Universities Industry Bodies / MoU / Action Plans <i>Eurocontrol</i> NASA / MIT / FAA EATRADA, ASDA,



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Centre of Excellence for ATM
 Independent
 Innovative
 Customer oriented
 Complete Network of Research Facilities





#### **AT-One - Facts & Figures**

- Strategic Alliance of DLR Institute of Flight Guidance and NLR Air Transport Division
- ✓ Shareholders: 50% DLR, 50% NLR
- Locations: Braunschweig, Amsterdam, Brussels
- ✓ Total employees: ~ 280
- ✓ Yearly Turnover: ~ 35 M€
- Background: additional 1400 employees in Air Transport Research



# One of the largest ATM research organisations in the world

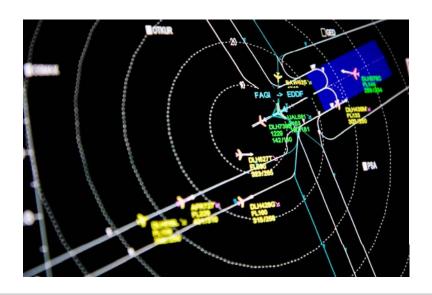


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#### **Overview**

- ✓ DLR at a Glance
- Motivation for CDM and for TAM





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Airport Operations - something in common with...?

World Wide Web

SWIM System Wide Information Management



**Finding Information** 

# WikipediA

### Prepare and Deliver Information



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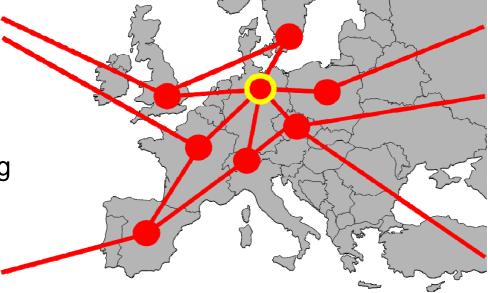
#### **Motivation - Current Challenges (I)**

Currently European ATM-System is fragmented

- ✓ Various ANSPs (~40) control and steer
- ✓ virtually no information sharing between Airports
- Problems at one single airport escalate throughout the entire network

Insufficient share of information between stakeholders

- data incomplete, outdated, possibly unreliable or missing
- opposing targets due to competing interests
- no integrated approach connecting landside and airside







#### **Motivation - Current Challenges (II)**

Stakeholders are opting for an optimization of their own processes and operations but:

- minor knowledge of impacts on other stakeholders caused by decisions made
- own process optimization suffer from limited "situational awareness"

Stakeholders are compromising the system by

- ✓ phantom flights CFMU planning is based on wrong data
- resulting in an overdemand caused by phantoms -> SLOT!?
- selection of the best fitting phantom and cancels the remaining



#### **Motivation - Requirements for TAM**

#### A need for:

- → a performance increase of the ATN
- more dynamic and responsive ways of incorporating the airspace users' and passenger needs
- pro-active instead of re-active planning
- possibilities to cope with competing interests at an airport in a fair and transparent manner
- an increase of the predictability of the "system airport"

SESAR (Single European Sky ATM Research) prescribes a performance-based ATM-System. Therefore it is required:

Only performance based airport processes enable a

performance based Air Traffic Management System



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#### **Approaches - Information Sharing (I)**

# Local Optimization of individual Stakeholders



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#### Building blocks... Airport-CDM as a Baseline...

SEPL-Dialog DFS North (FLF700)							
Application Edit View Sort MDI							
wutc Runway Capacity		<pre>@ CTOT Off</pre>					
SUG On CAB Warning		Off Line					
NR	MAS	CSN	* TSAT TOBT A CTOT	SID MDI EOBT			
1	<	BAG82C	06:28 06:26*	GIV 06:30	-		
2	<	GWI081	06:30 06:30	GIV 06:30			
з	^	DLH828	06:35 06:35*	GIV 06:35			
4	-	SWR1121	<mark>06:40</mark> 06:40*	RID 06:40			
5	^	RUS1531	06:42 06:40	EVI 07:01 06:40			
6	she	LGL9722	06:56 06:55	RID 06:55			
7	>	DLH1372	06:55 06:55	RID 06:55			
8	+	DLH040	07:01 07:00*	MIQ 07:00			
9	*	DLH9EH	07:03 07:03	ANK 07:00			
10	+	DLH6UX	07:10 07:05*	MIQ 07:05			
11	+	DLH1YK	07:05 07:05*	MIQ 07:05			
12	+	LTU414	07:12 07:10* 07:40	GIV 07:00			
13	+	DLH8UJ	07:15 07:10*	MIQ 07:10			
14		DLH362	07:14 07:10*	MIQ 07:10			
15	+	DLH9JX	07:15*	GIV 07:15			
16		DLH7AJ	07:15*	GIV 07:15			
17		DAT56V	07:20*	GIV 07:20			
18	+	DLH55P		GIV 07:05			
19	+	DLH2JC		ANK 07:05	10000		
20		DLH8PP		GIV 07:15			
21	+	DLH4KJ		ANK 07:05			
22	+	DLH967		GIV 07:20			
23		DLH8FF		GIV 07:20			
24		DLH9TK		GIV 07:20			
25		DLH7PL		MIQ 07:20			
				6.TH	-		
+ DLH6UX -DACHF -LH : 10 (RMT) =10 (TXT) +0 (RDY) +0 (DCT) CAP: 30 POS: 326E SID: MIQ6N							
C C3	3:30	GWI081 :	CAB expired!				



#### **Collaborative Predeparture Sequence**

#### **CDM in adverse conditions**

#### **Collaborative Management of Flight Updates**

The Milestones Approach

#### Variable Taxi Time Calculation

#### **Airport CDM Information Sharing**

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**Approaches - Information Sharing (II)** 



#### **Information Sharing**

between Stakeholders

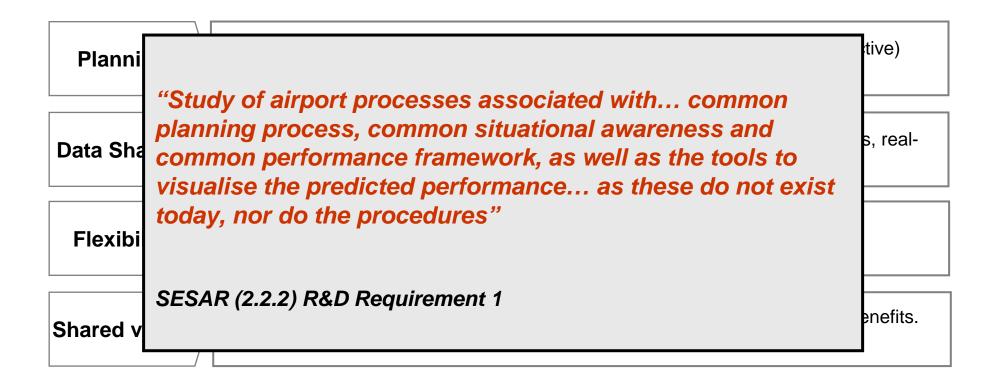
#### Local Optimization of individual Stakeholders

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#### ...but some problems are inherent



#### Where do we take Airport-CDM from here?



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Joint Airport Operations Planning & Execution -> Global Optimization

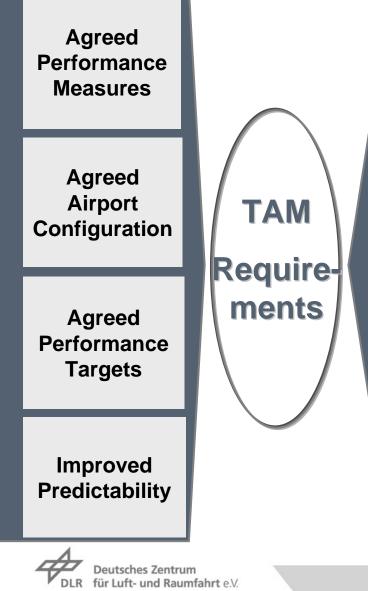
Information Sharing among stakeholders

Local optimization at airport stakeholders

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#### **TAM – Generic Requirements**



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Common computer aided (performance) assessment and simulation.

Common monitoring leading to a more adaptive system.

Representation of information via common displays based on common data sources.

Creation, agreement and maintenance of the airport operational plan (AOP) including performance trade-off analysis.

Common decision-making for a leading to a common understanding of future system evolutions.

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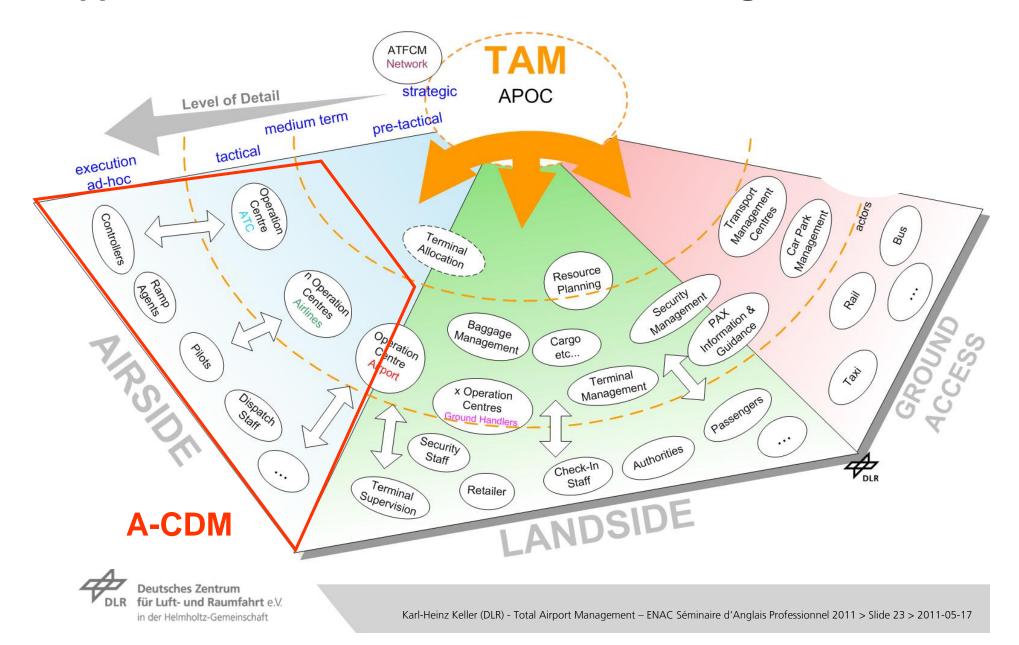
**TAM – Main Prerequisites** 

A-CDM is the baseline

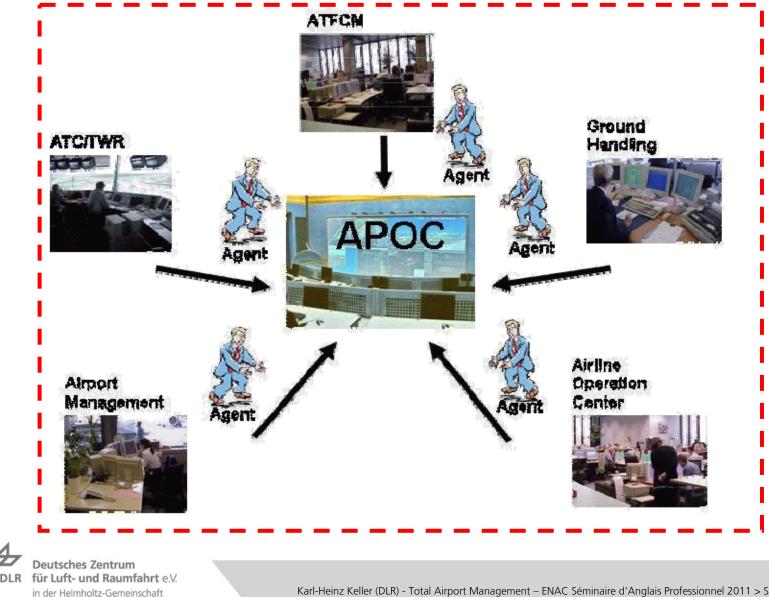
- & TAM Concept
- & Technologies / Facilities
  - Airport Operations Control Center (APOC)
  - Interfacing with tactical management tools and centers (A-SWIM), integrating an Airport Operational Database (AODB)
  - Development of new tools (e.g. Total Operations Planner TOP)
- & Cultural Changes
  - holistic approach integrating airside and landside
  - ✓ benefits from global optimisation vs. local optimisation
  - working together towards common agreed goals

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#### **Approaches – Pre-tactical and Holistic Management**

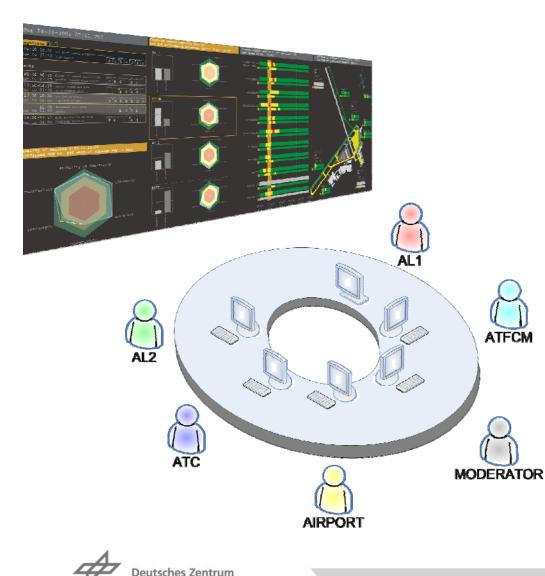


#### **Approaches – Airport Operations Control Center (APOC)**



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#### **Approaches - Joint and Collaborative Negotiation**



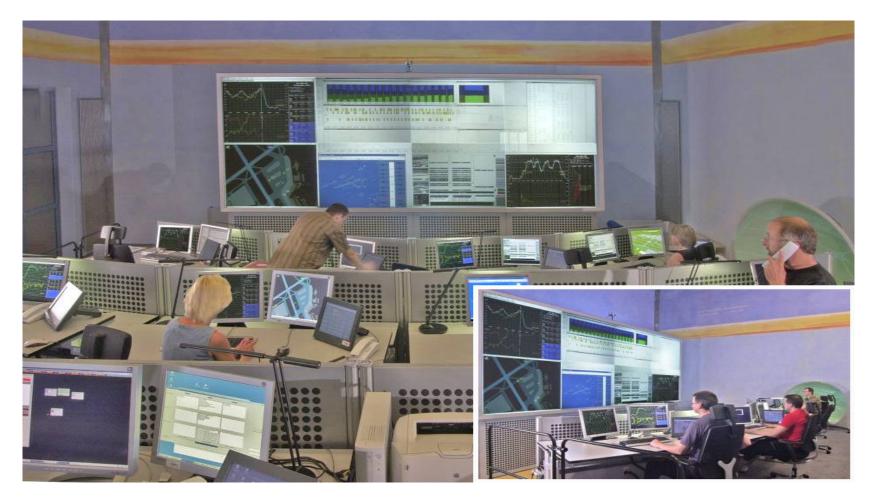
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- creation of a joint and common situational awareness
- transparent und fair handling by introduction of strict rules and regulations
- taking into account sensitive business data and privacy
- "Use Cases" for often recurring default situations
- enabling "What-If"-exploration to find alternative solutions



#### **Approaches - Validation Plattform ACCES**



 Validation Infrastructure: ACCES – Airport and Control CEnter Simulator a working- and simulation environment and flexible infrastructure

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#### **Overview**

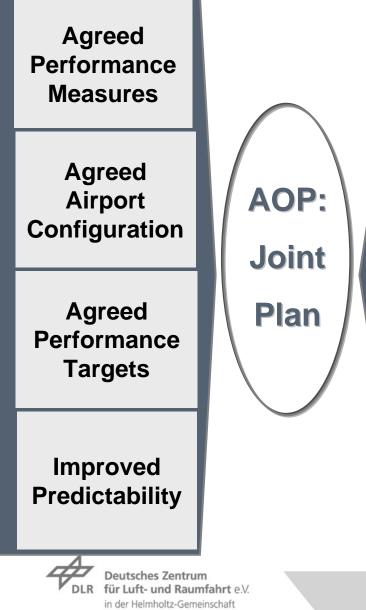
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#### **TAM – Expected Benefits (I)**



Based on commonly agreed performance indicators, TAM will allow for an assessment and visualization of future airport performance. Introduction common databases and systems.

This will allow operators to configure the airport according to agreed "scenarios" most applicable at the time of decision.

Demand and capacity management are organized to meet agreed performance targets for different time horizons. Also able to change the performance objective.

Based on an environment which is designed around the philosophy of information sharing. Past performance used to identify future requirements.

#### **TAM – Expected Benefits (II)**

- Agreed Airport
   Operations Plan (AOP)
- AOP includes

   a performance level
   commitment to ATN
- Early planning and pro-active operations increasing airport's predictability; better resource utilisation...
- NOP receives early planning data for more efficient and optimal sector capacity and trajectory planning
- The user's wishes submitted by 4D-business trajectories potentially can be much more efficiently be incorporated

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#### Conclusion

Total Airport Management (TAM)

- will be the successor of A-CDM, for pretactical planning and execution of AOP
- is the holistic approach (landside and airside) towards airport operations optimisation
- Ieads to commonly agreed performance targets - global optimisation @ airport
- ✓ will change stakeholders cultures...



#### The work of DLR in TAM context

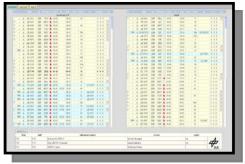
**Development of Concepts** 

- ✓ Operational-, technical-, simulation- and validation- concept
- ➤ Airport Operations Plan (AOP)
- Negotiation procedures (with system support)
- Bonus malus system (to avoid cheating)



**Functionalities and Tools** 

- ✓ Flight planning system, Total Operations Planner (TOP)
- ✓ Client working positions
- ➤ Display for video wall
- Common used database
- ✓ Interfaces to tactical systems
- Simulation environment for test campaigns
- ✓ Systems for analyzing, rights control, data fusion etc.







## **Thank You!**

# **Questions?**

For further information contact

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