Air-to-Air Triathlon

ATRiCS

Barco Orthogon

INFORM

Joint What-If

Barco – DLR – Inform – Siemens –Stuttgart Airport / *associated* ATRiCS
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Air-to-Air Triathlon

- **Triathlon:**

  Swimming, bicycling and marathon,

  three different areas of fitness – *one competition*.

- **TAMS Joint What-If:**

  ATC, Airport and Airline driven by safety and efficiency,

  three different stakeholders – *one Air-to-Air process*

- **Three solution providers, one integration**

ATRiCS BARCO Visibly yours INFORM TAMS

Information instead of resources

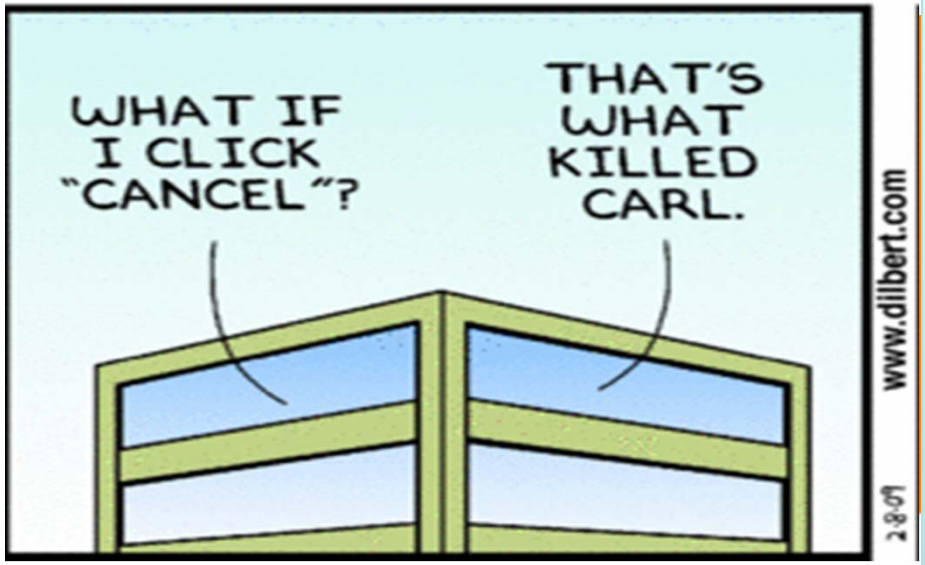
Lindberg´s Spirit of St. Louis (1927)

- Fuel reserve to compensate lack of information

Fossett´s Global Flyer (2005)

- Satellite communication and navigation to compensate lack of fuel

What If …


WHAT IF I CLICK "CANCEL"?
THAT'S WHAT KILLED CARL.
www.dilbert.com
2-8-09

Air-to-Air Triathlon

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Joint What-If

Company Introduction

ATRiCS
advanced traffic solutions

ATRiCS provides:

intelligent ATM solutions

Founded in 2002
Based at Freiburg Airport in Germany
20 highly educated employees
Software solutions and consulting services
Exclusive focus on Air Traffic Management
ISO 9001:2008 certified

Tower Surface Management System

Jane's ATC Award for Innovation 2012
Runway Incursion Prevention and Detection
Pilot Conformance & ATC Clearance Monitoring
Routing, Guidance and Control
4D Trajectory-Based Planning

Airport Collaborative Decision Making

Traffic Event Detection
Advanced Taxi Time Calculation
Pre-Departure Sequencing
Sequence Analysis

Simulations

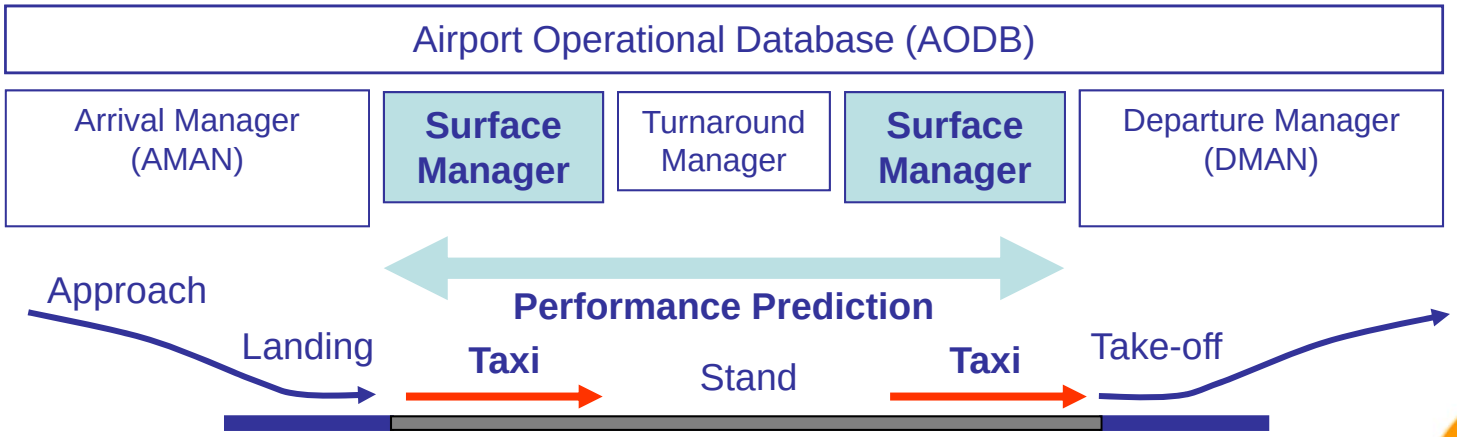
Operational Concept Validation and ATCO Training
Benefit Assessment and System Verification Tests

Introduction

- Major contribution to TAMS:

Surface Manager – the connector of air and ground

- Advanced taxi time calculation
- Pre-departure-, off-block and taxi-sequencing
- Automated guidance – “following the green”
- Situational Awareness
- Joint What If



Predict – Plan – Control

- **Prediction** – ***gather Information***
  - Advanced taxi time calculation

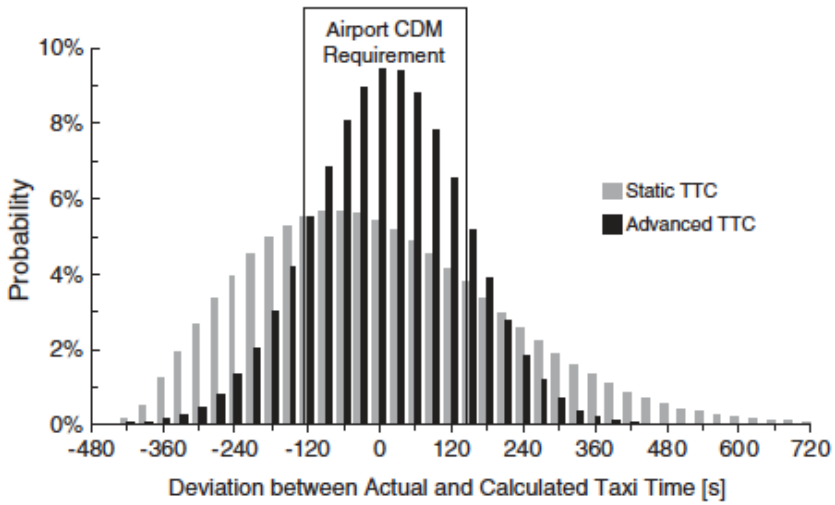
- **Planning** – ***take a decision***
  - Long Term:
    - Strategy: taxiway routing patterns
  - Short Term
    - PreDeparture, Off-Block and Taxi Sequencing

- **Controlling** - ***carry the decision into execution***
  - Active routing and guidance – *following the green*

Advanced taxi time calculation

- **Static Tables**
  - Changes on…
    - o Infrastructure
    - o Traffic Situation
    - o Input Datas

    … has no impact



Günther, Hildebrandt, Fricke and Strasser: „Contributions of advanced taxi time calculation to airport operations efficiency“, Journal of Aerospace Operations 1, 2012

- **Advanced**
  - Real-time calculation
  - Differentiate between Unimpeded and Impeded times
  - Increase prediction quality while the process
    - o Updates by sequencing results
    - o Taking ground surveillance into account

Decision Opportunities

- *real Time*
- *medium term*
- *very long term*

SMAN automated planning and routing

Collaborative planning of DMAN and SMAN

SMAN parameters as part of different airport strategies

individual guidance

taxi sequencing

pre departure sequencing

taxiway routing patterns

Stand coordination

Impact of new

Relevant decision in an APOC

Piekert and Strasser: *„Potential Impact of Data Variance on the Prediction of Key Performance Indicators (KPI) as a Decision Variable for Airport Pretactical Decision Making within a Total Airport Management (TAM) Airport Operations Center (APOC)“* Tokyo, Japan. EIWAC 2010

Taxiway routing patterns

- **Operative**

Standard routing pattern

- **What-If probing**

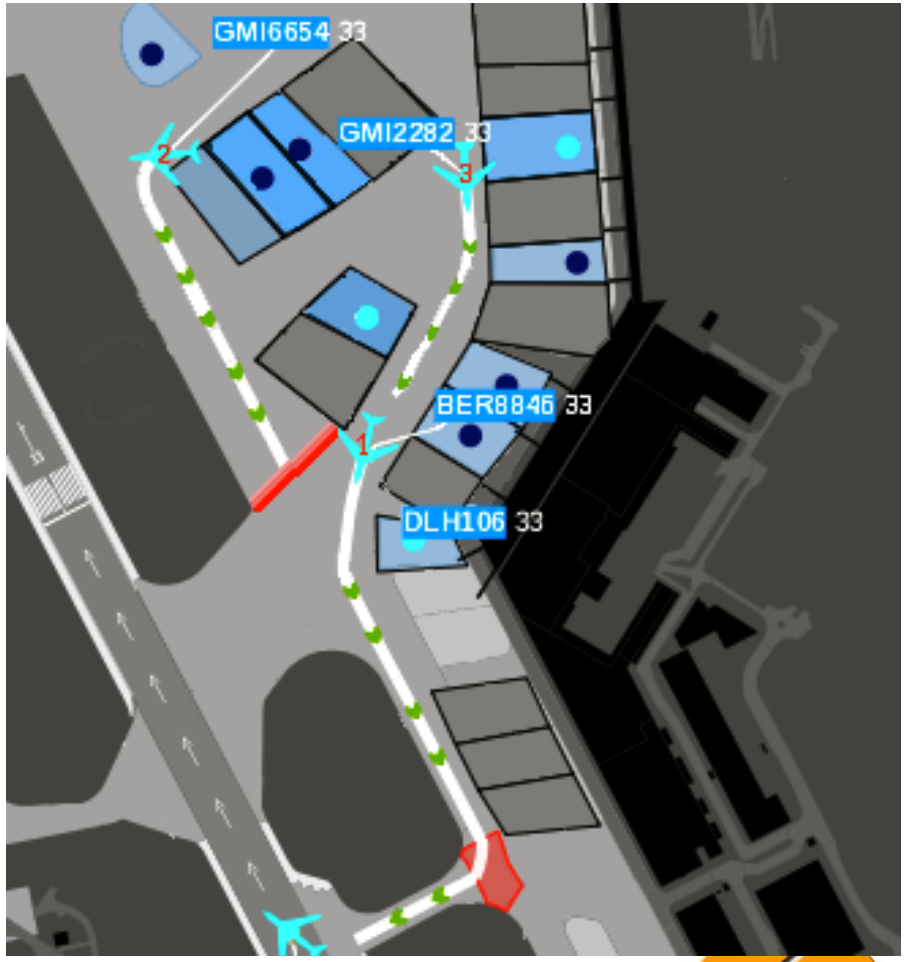
Alternative routing pattern

ATR1; ATR2; ATR0

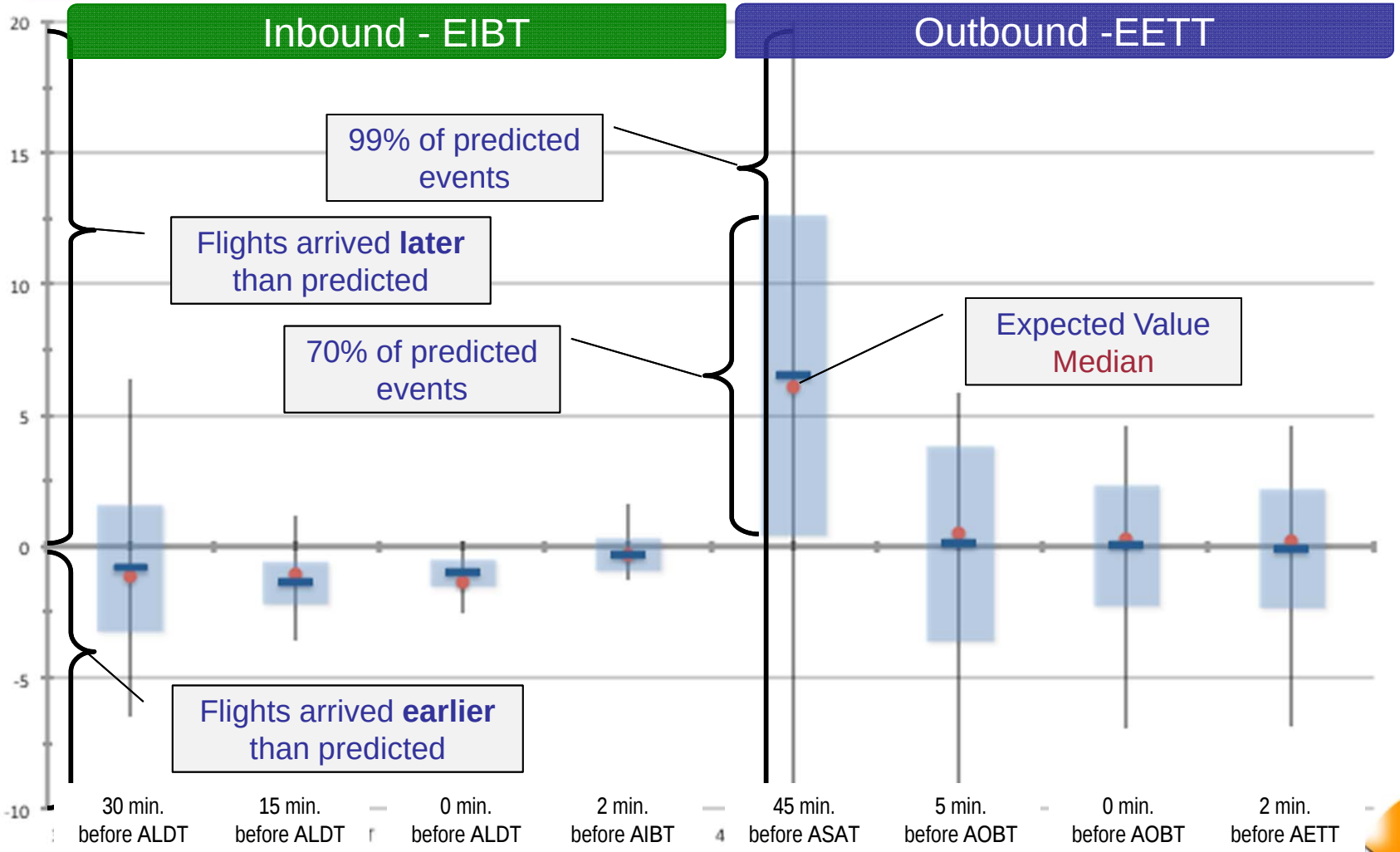
ATR1; ATR0; ATR2

Taxi-Sequencing

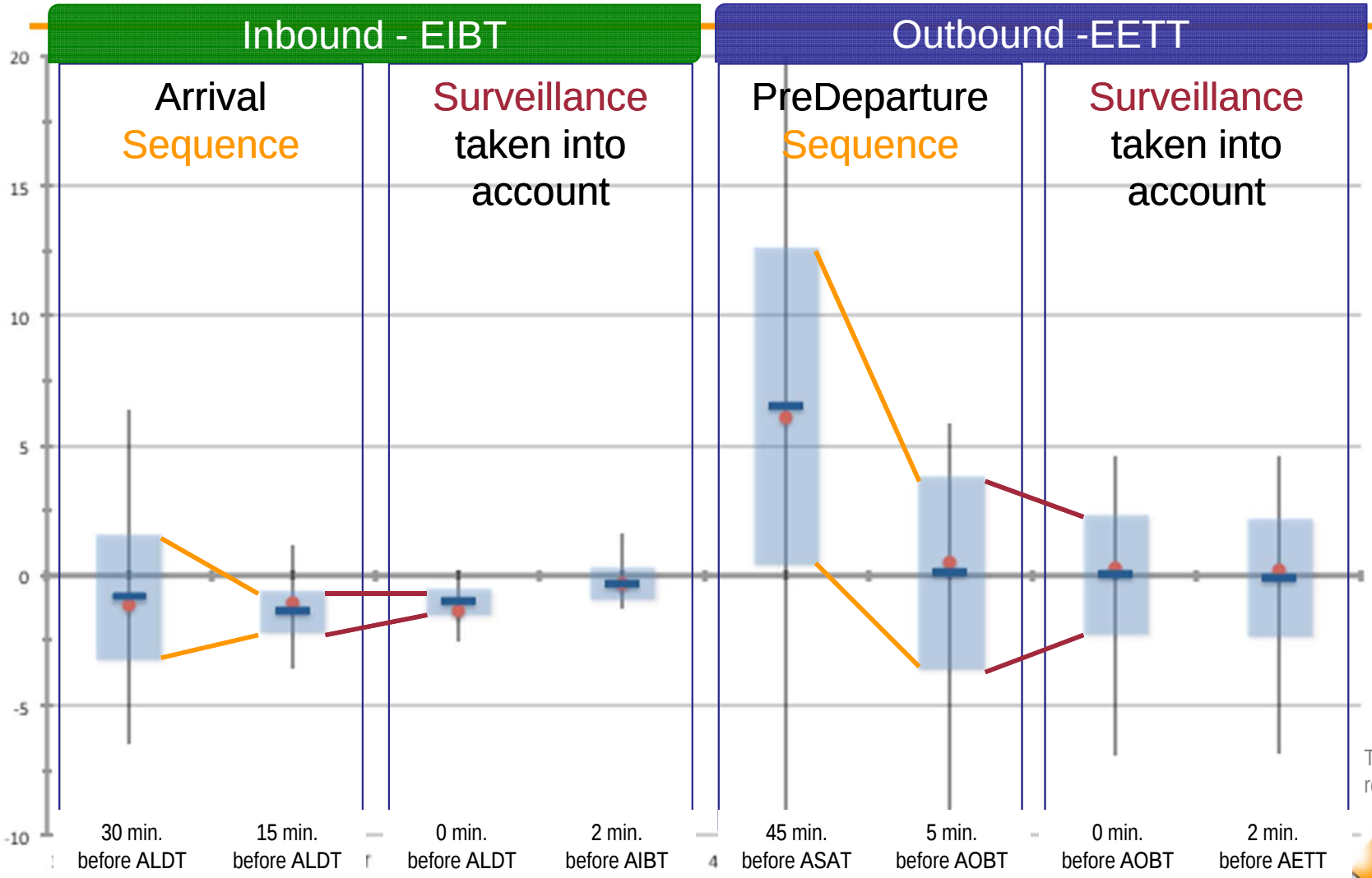
- A startUp sequence is **not** a takeOff sequence
- Taxi Sequencing
  - Optimised take off order
  - Reduce stop and go traffic
- Individual guidiance
  - Control the planed taxi-sequence



Simulation Results



Simulation Results



TAMS Validation, realized by DLR 2012

Air-to-Air Triathlon

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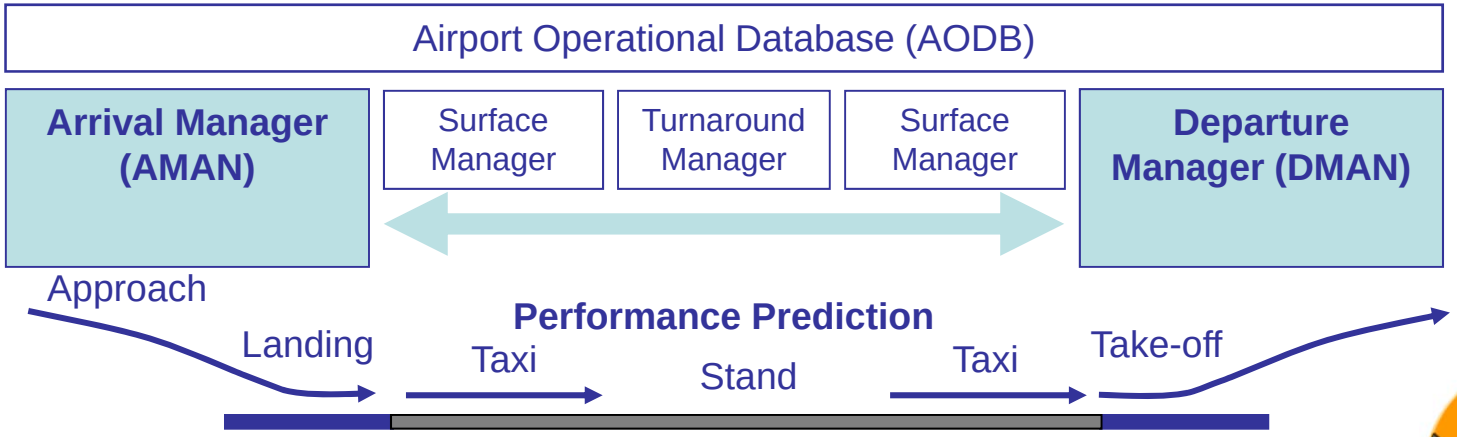
Joint What-If

Company Introduction

- Orthogon GmbH founded 1987 in Bremen
- since 2002 100% subsidiary of Barco N.V.
- specialized in software for ATC, Airlines and Airports
- approximately 75 employees
- World wide business with system integrators and ANSP

Major Contributions

- Major contribution to TAMS:
  - Airside Tactical Working Position
  - ODS Open Platform
  - Airside performance prediction and performance assessment
  - Coupled Arrival & Departure Management (incl. “What-if” probing)
  - Interfacing of ATC tools with airport infrastructure (i.e. AODB)

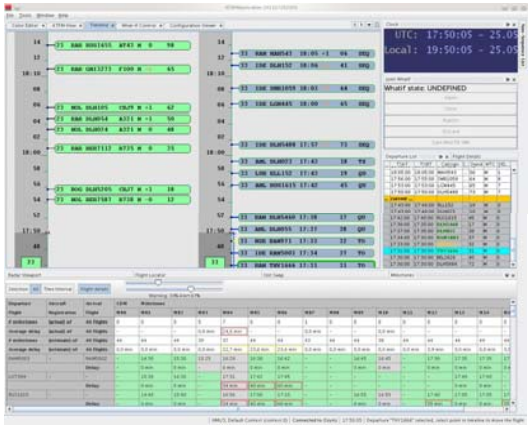


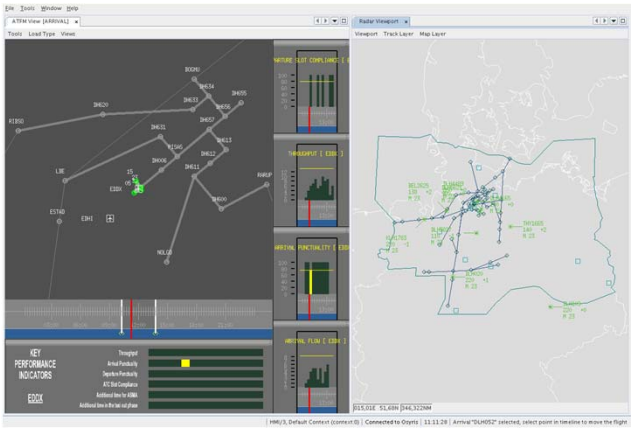
Airside Tactical Working Position (ATWP)

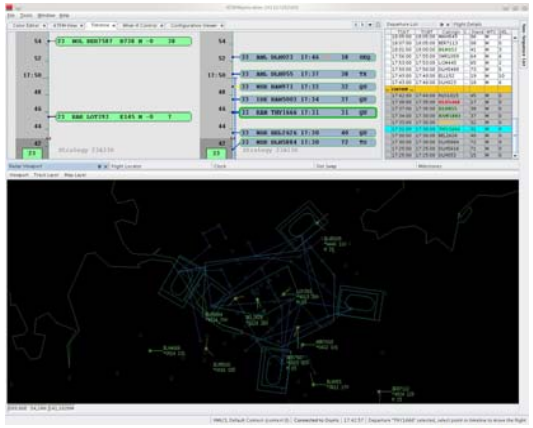
- Operational Requirements
  - Focus on collaborative airport planning in APOC
  - ATC agent in APOC needs specialized working position (ATWP)
  - ATWP displays relevant information for ATC agent
  - ATWP provides interface to tactical planning tools (AMAN / DMAN / SMAN)
  - ATWP provides collaborative decision support functionality
- System Requirements
  - Modular HMI Framework to provide information in different situations / for different roles
  - New and adapted views to show aggregated information
  - Adaptations and enhanced queue management functionalities

ODS Open Platform

- Integration of HMI components from different contributors
- Centralized data model
- Adaptable layout
- Interaction between HMI components (e.g. highlighting)
- Consistent presentation (e.g. pre-defined color schemes)
- Modular and open architecture

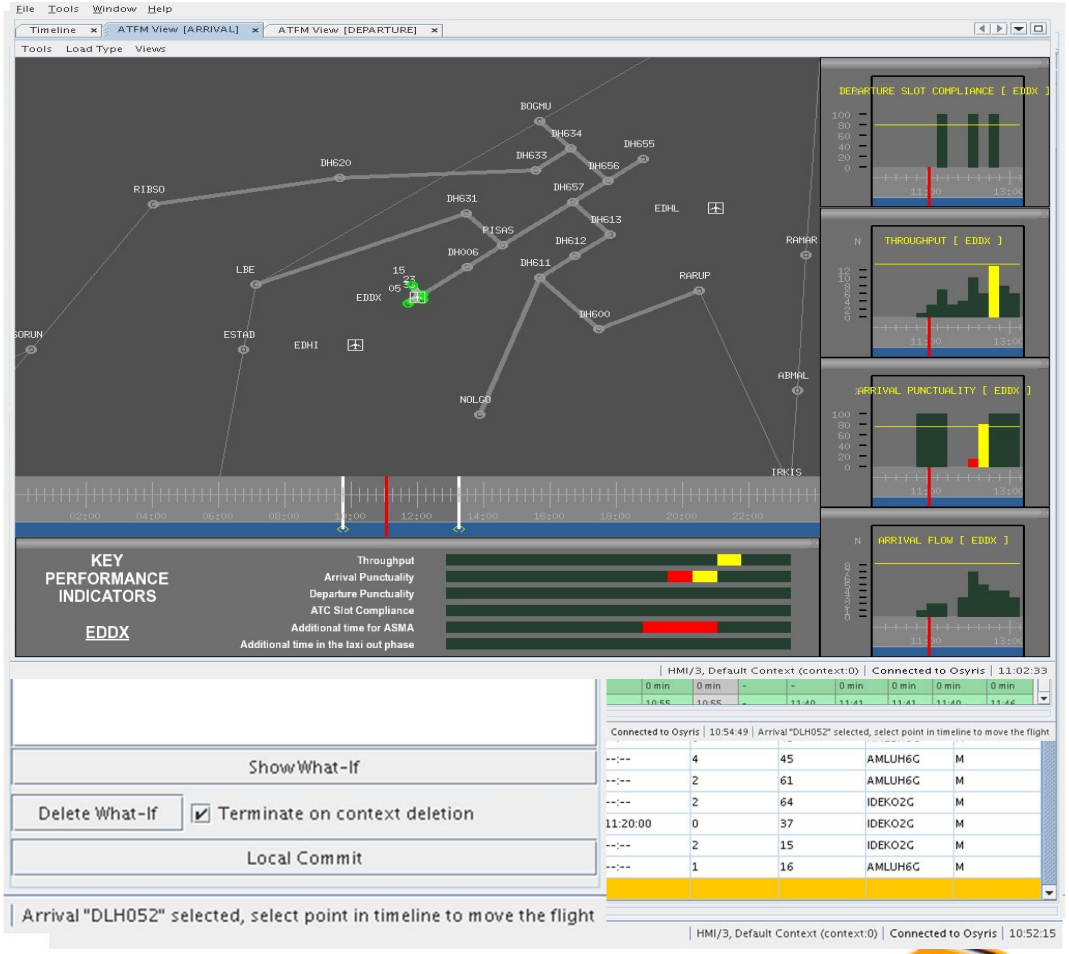






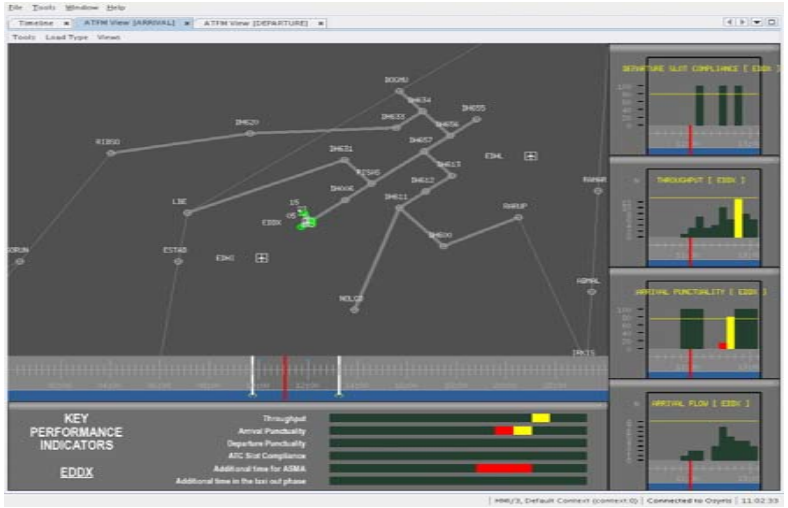
Airside Tactical Working Position (ATWP)

- Airspace surveillance
- Arrival and departure sequence
- Pre-departure sequence
- Aggregated milestones
- Tactical Joint What-If
- Air Traffic Flow and Key Performance Indicators



Airside Performance Prediction

- Collaborative Decision Making at airport operations center for airside processes
- Demand Prediction for runways as well as arrival & departure routes (SID/STAR)
- Performance prediction based on standardized[1] ATM Airport Key Performance Indicators (KPI):
  - Capacity (runway throughput)
  - Arrival punctuality
  - Departure punctuality
  - ATC slot compliance
  - Additional time for ASMA[2]
  - Additional time in the taxi-out phase

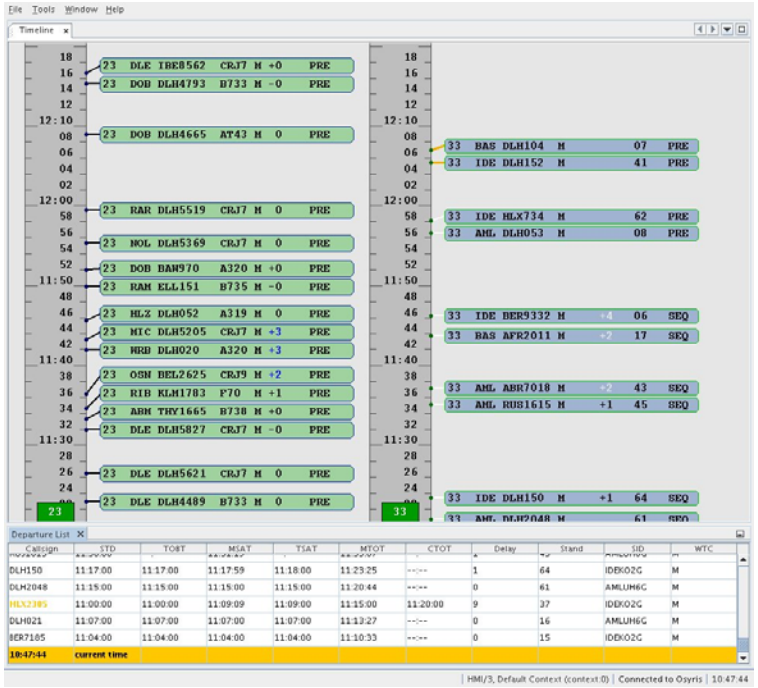


[1] Airport Key Performance Indicators according to:
- ATM Airport Performance (ATMAP) Framework (Eurocontrol, December 2009),
- Performance Scheme for Air Navigation Services (EU Regulation No 691/2010, July 2010).

[2] ASMA: Arrival Sequencing and Metering Area

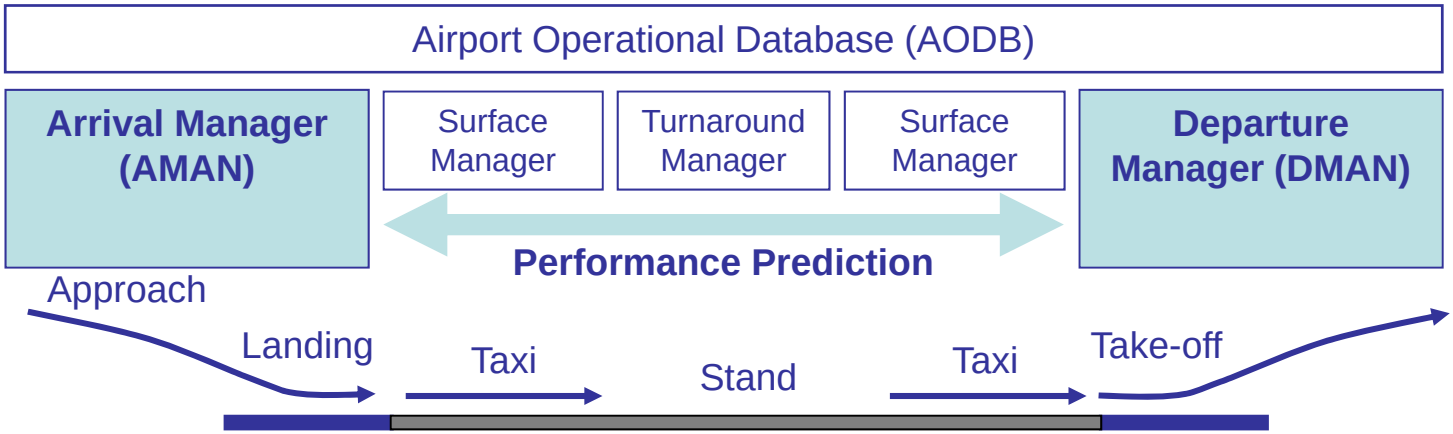
Airside Process Optimization

- Coupled Arrival & Departure Management (AMAN/DMAN)
- Runway capacity utilization improved and balanced in accordance with predicted demand:



- Gaps in arrival sequence to handle departure peaks
- Runway balancing for multiple runway systems
- Pre-Departure Sequencing compliant to Airport CDM concept
- “What-If” probing to judge different strategies

Integration with Airport Infrastructure



- AMAN / DMAN coupled with AODB as an integral part of TAMS
- Procedures (information exchange) and solutions (system interfaces)
- Tactical Joint What-If supports collaborate decision making
- VTTC and Taxi-Sequencing integrated with DMAN and SMAN

Exploitation of TAMS Results

- Follow-up project "META-CDM"[1] (Kick-Off in July 2012) focuses on close discussion with airport stakeholders aiming for:
  - Promotion of current TAM R&D status
  - Roadmap to bring R&D results into operations
  - Follow-up R&D to provide further benefits

- OSYRIS Queue Management Demonstration System
  - Will Integrate TAMS developments
  - Will allow stakeholders at worldwide airports to assess benefits

- Further collaboration with TAMS partners envisaged to make use of R&D results for future product development

[1] META-CDM: "Multimodal, Efficient Transportation in Airports and Collaborative Decision Making", (Coordination and support action within the EU Seventh Framework Programme)

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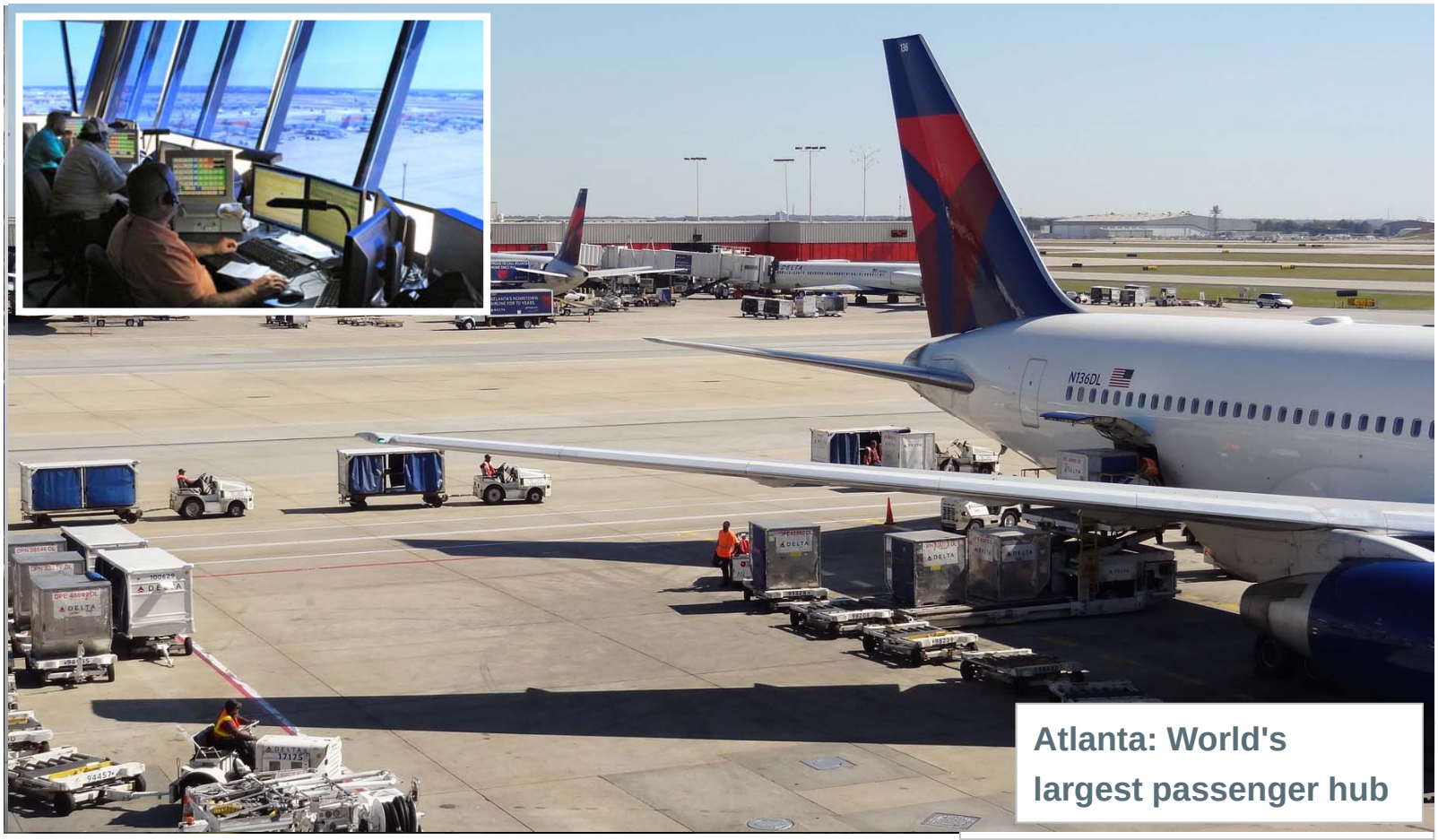
Joint What-If

Company Introduction



Atlanta: World's largest passenger hub

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Company Introduction

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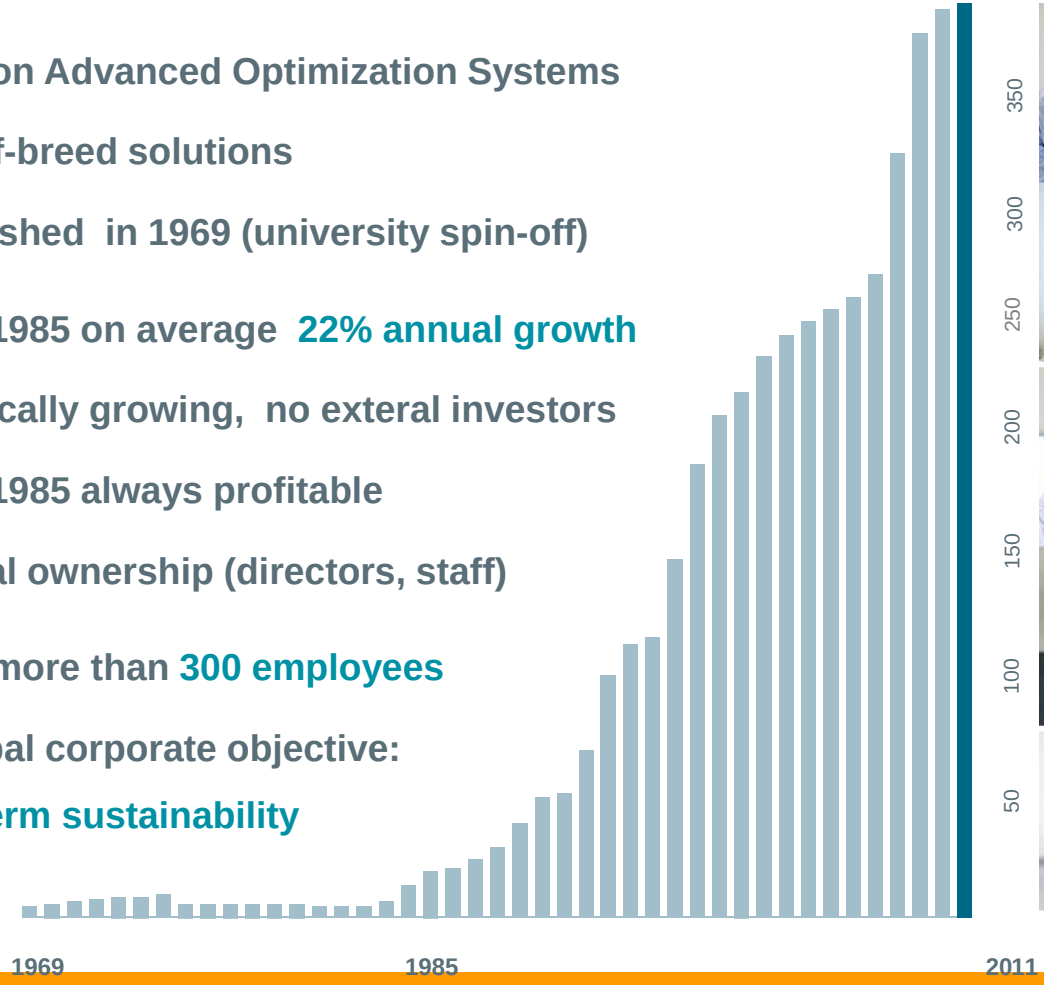
- focus on Advanced Optimization Systems
- best-of-breed solutions
- established in 1969 (university spin-off)
- since 1985 on average **22% annual growth**
- organically growing, no exteral investors
- since 1985 always profitable
- internal ownership (directors, staff)
- today more than **300 employees**
- principal corporate objective:
  long-term sustainability



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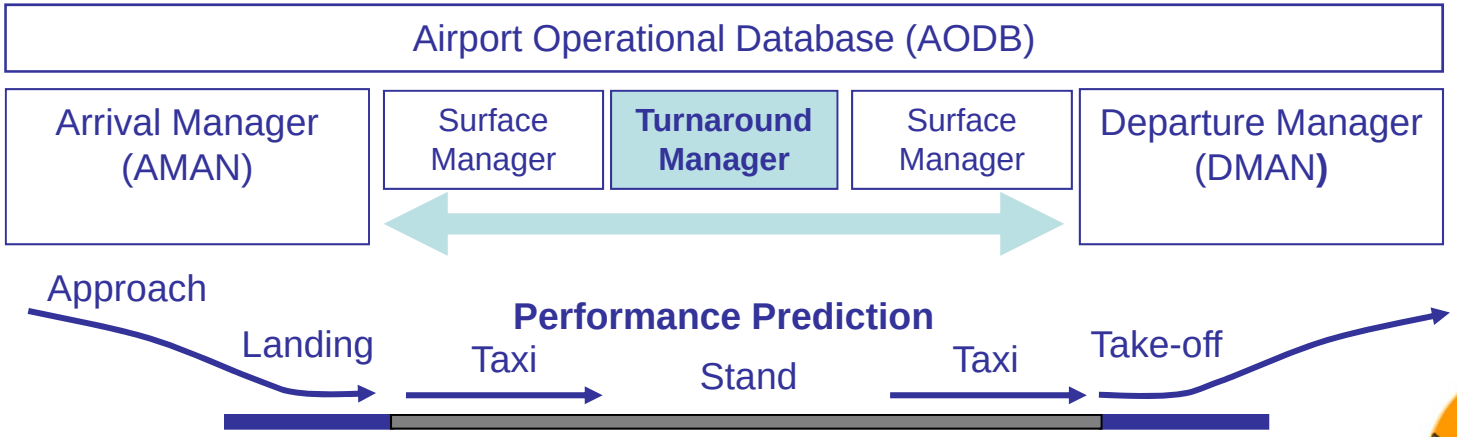
Major Contributions

- **Major contributions to TAMS:**
  - Airline and Ground-Handler Working Positions
  - Target Offblock Time Prediction
  - APOC HMI Design
  - A-CDM Empowerment/ CSA Tool for 16 Milestones
  - Airline Preferences Determination
  - Joint What-if Design and Prototype



TMAN Turnaround Manager

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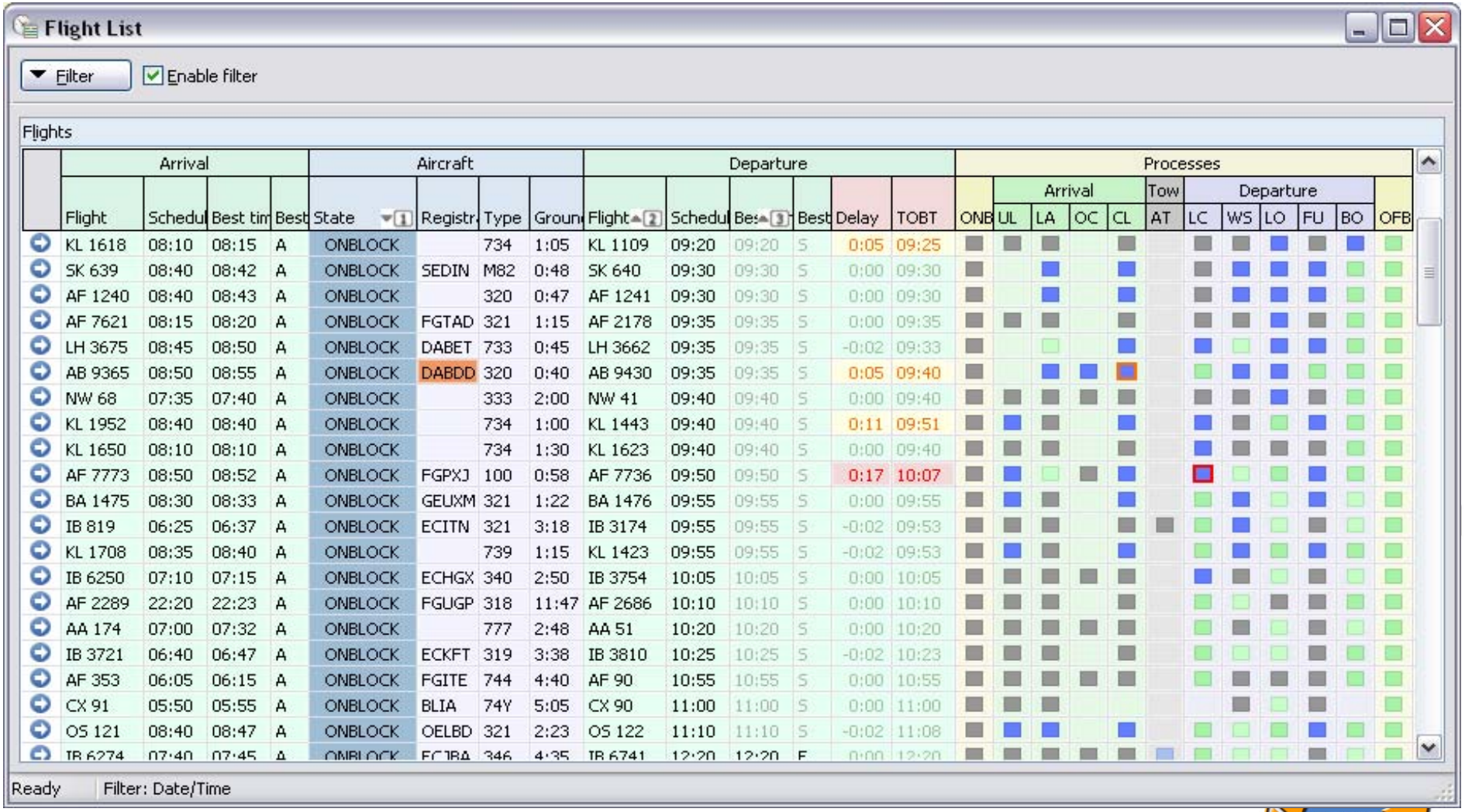

Flight List

Filter | Enable filter

Flights

	Arrival				Aircraft				Departure						Processes											
																Arrival				Tow	Departure					
	Flight	Schedul	Best tim	Best	State	Registr	Type	Groun	Flight	Schedul	Bes	Best	Delay	TOBT	ONB	UL	LA	OC	CL	AT	LC	WS	LO	FU	BO	OFB
	KL 1618	08:10	08:15	A	ONBLOCK		734	1:05	KL 1109	09:20	09:20	S	0:05	09:25												
	SK 639	08:40	08:42	A	ONBLOCK	SEDIN	M82	0:48	SK 640	09:30	09:30	S	0:00	09:30												
	AF 1240	08:40	08:43	A	ONBLOCK		320	0:47	AF 1241	09:30	09:30	S	0:00	09:30												
	AF 7621	08:15	08:20	A	ONBLOCK	FGTAD	321	1:15	AF 2178	09:35	09:35	S	0:00	09:35												
	LH 3675	08:45	08:50	A	ONBLOCK	DABET	733	0:45	LH 3662	09:35	09:35	S	-0:02	09:33												
	AB 9365	08:50	08:55	A	ONBLOCK	DABDD	320	0:40	AB 9430	09:35	09:35	S	0:05	09:40												
	NW 68	07:35	07:40	A	ONBLOCK		333	2:00	NW 41	09:40	09:40	S	0:00	09:40												
	KL 1952	08:40	08:40	A	ONBLOCK		734	1:00	KL 1443	09:40	09:40	S	0:11	09:51												
	KL 1650	08:10	08:10	A	ONBLOCK		734	1:30	KL 1623	09:40	09:40	S	0:00	09:40												
	AF 7773	08:50	08:52	A	ONBLOCK	FGPXJ	100	0:58	AF 7736	09:50	09:50	S	0:17	10:07												
	BA 1475	08:30	08:33	A	ONBLOCK	GEUXM	321	1:22	BA 1476	09:55	09:55	S	0:00	09:55												
	IB 819	06:25	06:37	A	ONBLOCK	ECITN	321	3:18	IB 3174	09:55	09:55	S	-0:02	09:53												
	KL 1708	08:35	08:40	A	ONBLOCK		739	1:15	KL 1423	09:55	09:55	S	-0:02	09:53												
	IB 6250	07:10	07:15	A	ONBLOCK	ECHGX	340	2:50	IB 3754	10:05	10:05	S	0:00	10:05												
	AF 2289	22:20	22:23	A	ONBLOCK	FGUGP	318	11:47	AF 2686	10:10	10:10	S	0:00	10:10												
	AA 174	07:00	07:32	A	ONBLOCK		777	2:48	AA 51	10:20	10:20	S	0:00	10:20												
	IB 3721	06:40	06:47	A	ONBLOCK	ECKFT	319	3:38	IB 3810	10:25	10:25	S	-0:02	10:23												
	AF 353	06:05	06:15	A	ONBLOCK	FGITE	744	4:40	AF 90	10:55	10:55	S	0:00	10:55												
	CX 91	05:50	05:55	A	ONBLOCK	BLIA	74Y	5:05	CX 90	11:00	11:00	S	0:00	11:00												
	OS 121	08:40	08:47	A	ONBLOCK	OELBD	321	2:23	OS 122	11:10	11:10	S	-0:02	11:08												
	IB 6274	07:40	07:45	A	ONBLOCK	ECIBA	346	4:35	IB 6741	12:20	12:20	E	0:00	12:20												

Ready | Filter: Date/Time

TMAN Enhanced Decision Support

Integrated Airport Map

Air-to-Air Triathlon

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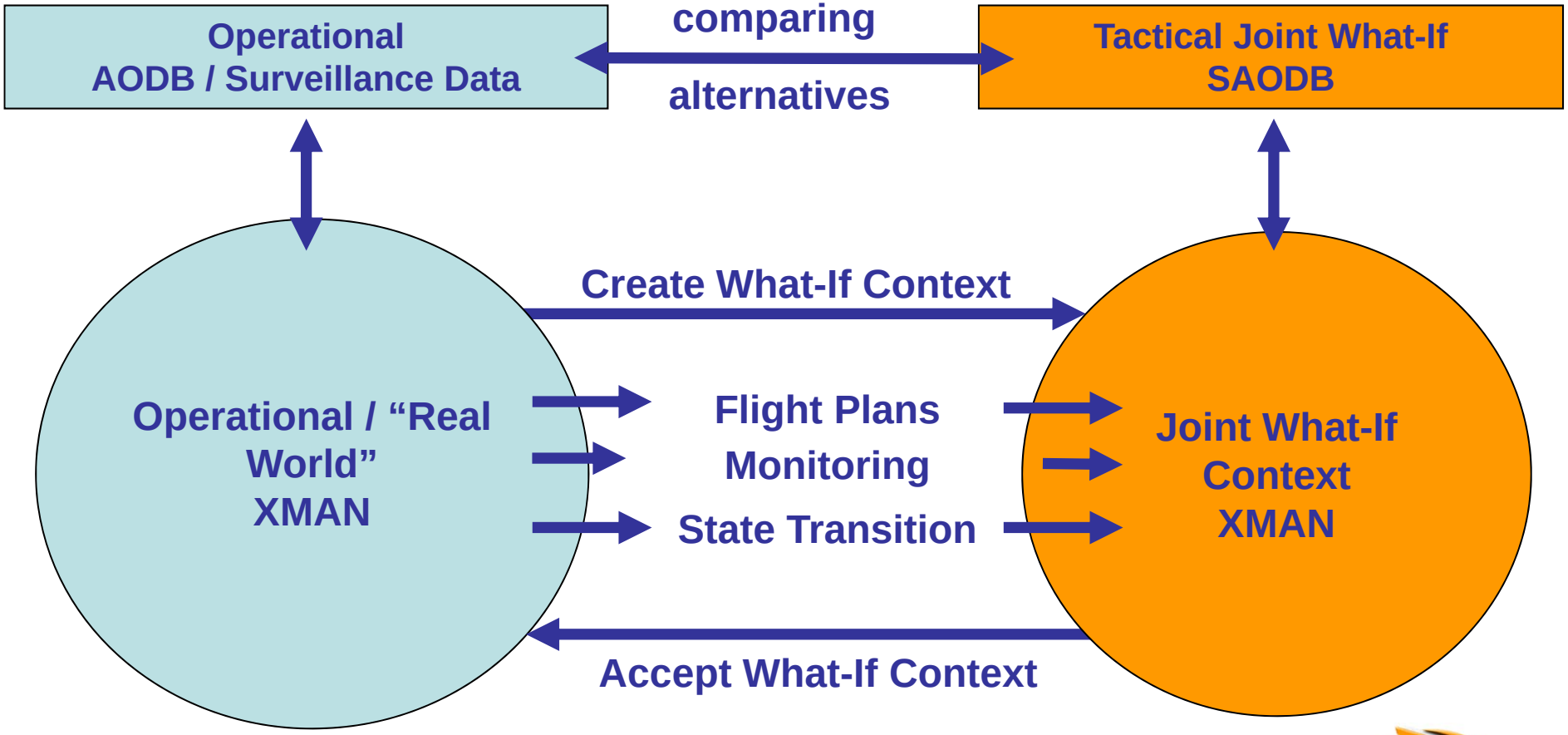
Joint What-If

Joint What-If

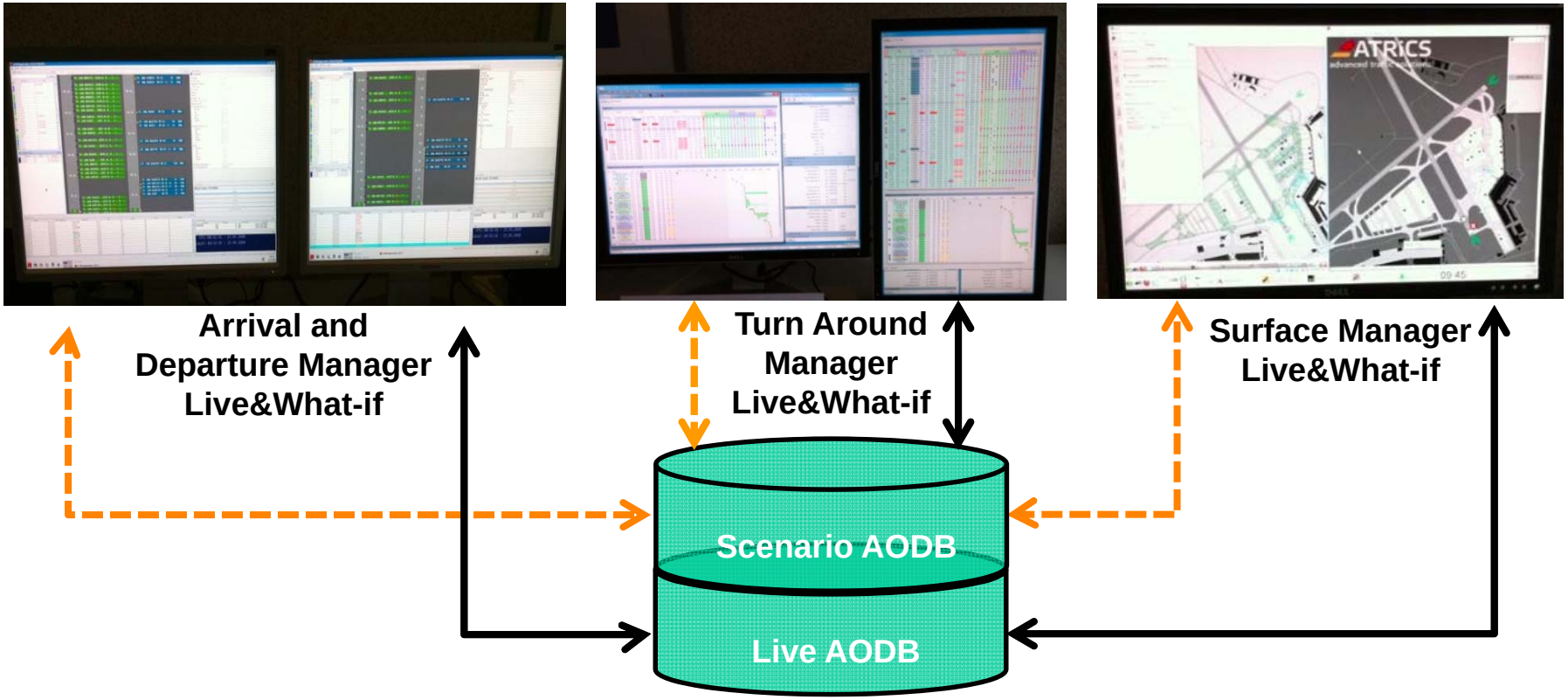
- What-if capability
  - taking a time slice up to several hours in advance
  - real-time data basis, transferring it into a „sandbox“
  - keeping the real-time feed of events

- Joint What-If probing
  - across all tactical tools
  - immediate check of considered mitigations
  - mutual agreement on joint solution

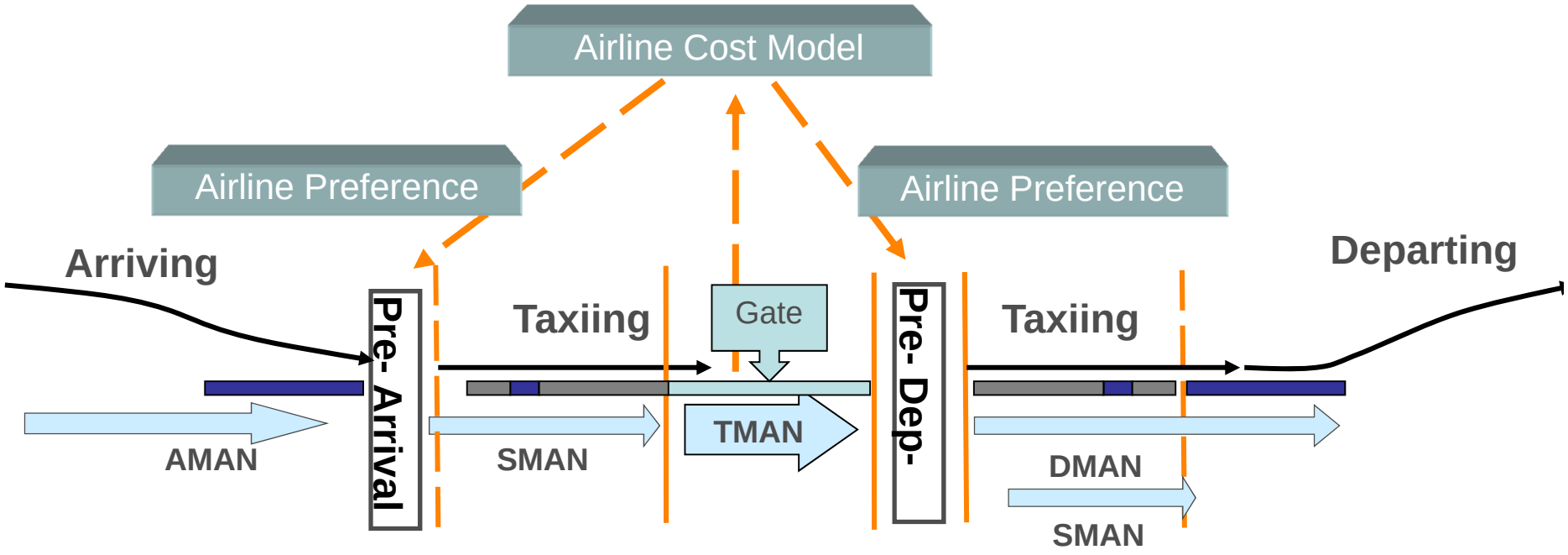
JWI Data Flow



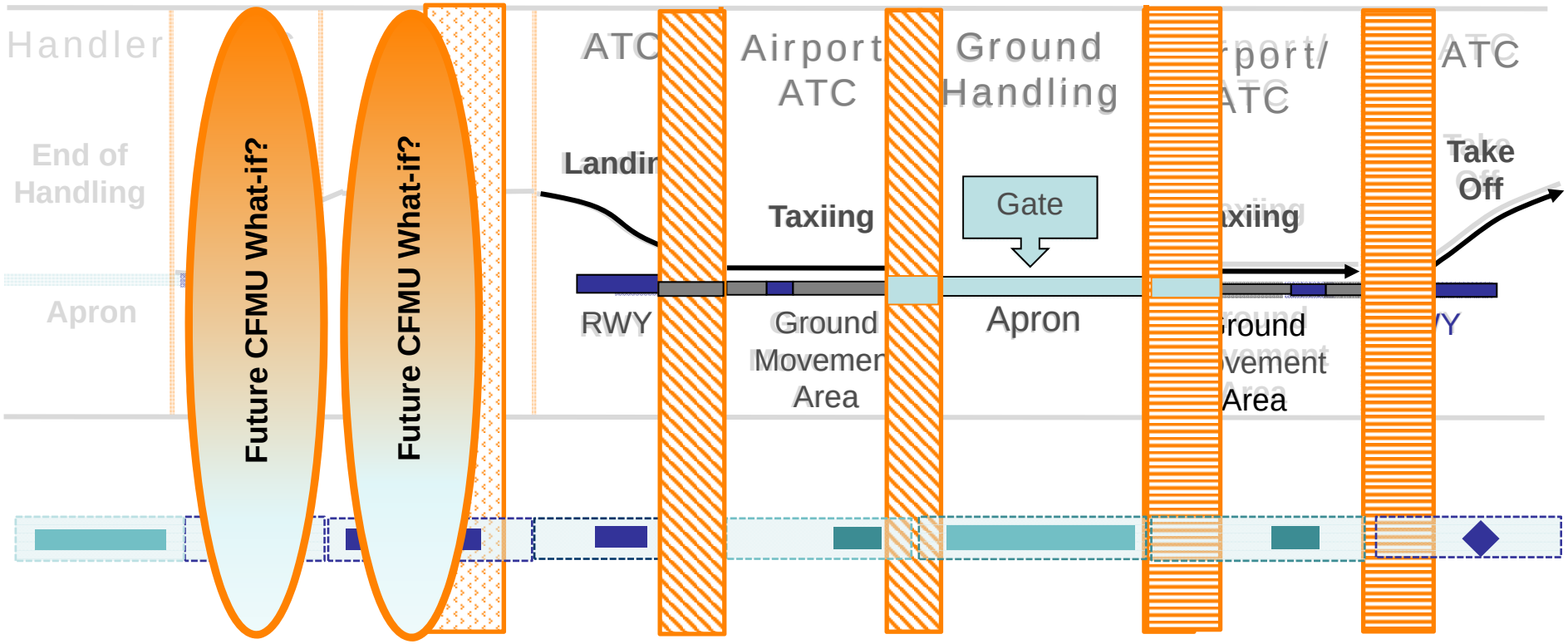
Joint What-If



Joint What-If



What-If …..future extension?



Thank you for your attention ...

... Thank you very much....