
Integrated „Air2Air“ Management
Taking Aviation Management beyond CDM
A-CDM Framework Defines Basis

1. Flight Plan
2. CFMU Slot (CTOT)
3. Take Off Outst. (ATOT)
4. FIR Entry/Local Radar Data
5. Final Appr.
6. Act. Landing (ALDT)
7. Act. In Block (AIBT)
8. Act. Ground Handling Start (ACGT)
9. Target Off-Block Est. (TOBT)
10. Target Start Appr. (TSAT)
11. Act. Boarding (ASBT)
12. Aircraft Ready (ARDT)
15. Act. Off-Block (AOBT)
16. Act. Take Off (ATOT)
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Company Introduction

- 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 external investors
  - since 1985 always profitable
- internal ownership (directors, staff)
- today more than 650 employees
- principal corporate objective: **long-term sustainability**

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Global Presence

- HQ in Aachen, Germany
- Offices in D, USA, HK, Australia
- Worldwide customer systems
- INFORM staff originating from more than 30 different countries

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Business Units

Aviation

GroundStar

Efficient Airport Operations

Airport Logistics and Airport Resource Optimization for
- Stands and Terminal Resources
- Passenger Services
- Ramp Services
- Catering
- Fueling
- Hub Management
- and other airport and ground handling operations

Inventory & Supply Chain

Production

Risk & Fraud

SyncroTESS
Efficient Logistics

SyncroSupply
Efficient Logistics

Optimized planning and real-time dispatch of
- Truck Fleets
- Container Transportation
- Building Materials Deliveries
- Intermodal Terminal Ops.
- In-plant Materials Handling
- Health Care Logistics

Add*ONE
Bestandsmanagement

InvEnt
Stichprobeninventur

As an add-on to existing IT systems, Add*ONE optimizes procurement and inventory control.
InvEnt optimises stock taking and goods inwards inspection by applying advanced sampling techniques.

FELIOS
Marktsynchronisierung

RiskShield
Turn Risk into Profit

As an add-on to existing ERP systems, FELIOS optimizes production scheduling for make-to-order type manufacturing companies.
RiskShield optimizes fraud detection and prevention for the banking and insurance industries.

Around 120,000 employees are being managed by GroundStar worldwide!

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Optimization of logistics processes in...

Atlanta: World's largest passenger hub

Swiss Post Parcel Centers

Hamburg CTB: Germany's largest container terminal
Application Areas

Terminal Applications
- Terminal Resources
- Passenger Service
- Check-in
- Security
- Borderpolice
- Immigration

Ramp Applications
- Ground Transportation
- Loading
- Cargo Handling
- Baggage Service
- Catering
- Stands/Gates
- Towing and Push-back
- Aircraft Services
- Cleaning
- Water and Toilet Services
- De-Icing
- Fuelling
- Maintenance

Overall Applications
- Airport Control
- Hub Control
- Capacity
- Flight Information
- Contract and Billing
Decision Support – Information availability

AODB
Flightschedule and updates

Hub System
Monitoring and Steering

Flight Information System (AODB)

Hub Monitoring and Steering

RMS
Resource Management System Allocation

Mobile
Communication Status Information

Gate Agent
Pushback
Fueling
Ramp Agent
Catering
INFORM

Air2Air Steering - Motivation

TMAN Turnaround Manager
SMAN Surface Manager
A/DMAN Arrival & Departure Integration

Results
Due to different functional and organizational areas of responsibility – the air transport industry has traditionally worked with process handshakes and buffer times in each area.
The result of this independent area's handshakes approach is the possibility to facilitate a different main focus on the airtransport logistics chain for each of the stakeholders.

... Try that in any other area of public transport, i.e. railway systems or public busses.....😊
Today’s Steering at Capacity Limits

- Shift Workload LEFT
- Shift Workload RIGHT
- Compress Workload
- Shift Workload RIGHT

- Holding

Arrival Management  |  Surface Mgmt  |  Turnaround Management  |  Surface Mgmt  |  Departure Management

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Air2Air Steering

TMAN Turnaround Manager
SMAN Surface Manager
A/DMAN Arrival & Departure
PaxMAN Passenger Flow
Integration

Results
Air2Air Steering is the capability to jointly steer the necessary sequential processes of the aircraft turnaround at an airport from prior to landing until just after take-off.

With full knowledge about the performance predictions of ATC, Local Aerodrome Control and Ground Handling.

Arrival Processes  | Surface Processes  | Turnaround Processes  | Surface Processes  | Departure Processes

Performance Prediction

Approach  | Landing  | Taxi  | Stand  | Taxi  | Take-off
Air2Air Steering Enables TAM

Total Airport Management (TAM)
A vision for the integrated airport management of the future

APOC - an integral node of the air transport network

APOC Agents
ATC

Operations - follow a common Airport Operations Plan (AOP)
The AOP is created, monitored and adapted in a joint Airport Operations Control Centre (APOC)

TAM integrates existing steering approaches like Ground Handler, Airport - CDM, X MAN and Advanced Surface Management Guidance and Control Systems into one holistic concept.

Aircraft Operators

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Motivation

Air2Air Steering

- TMAN Turnaround Manager
- SMAN Surface Manager
- A/DMAN Arrival & Departure
- PaxMAN Passenger Flow

Integration

Results
TMAN Ground Turnaround

- Major contribution to Air2Air:
  - Ground Handling operational transparency
  - Critical path handling awareness
  - Transfer connectivity awareness
  - Situational revenue and cost awareness
  - Steering capability
  - AODB integration for Air2Air
Multiple dispatch centers, acting singularly
- Not aligned business interests
- Lack of common planning/monitoring capability
- Multiple airlines

- Work execution based on default times
- Bad timing in execution of processes
Aggregated Information on APOC Level only

Similar Data Model – Different Levels of Detail

TMAN Collaborative: Airport, Airline, Ground Handler

TMAN Airport Setup
TMAN Airline Setup
TMAN Ground Handler Setup

Decision Support - TMAN Collaborative
TMAN Decision Support - Features

A-CDM Milestones integral with turnaround critical path

TMAN for Subcontractors

Transfer Pax/Bags Connect

Priority Flights Costmodel

Quick Turn Around

TMAN What-if

Service Recovery Key Performance Indicators

GS Integrated Airport Map

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Motivation

Air2Air Steering
- TMAN Turnaround Manager
- SMAN Surface Manager
- A/DMAN Arrival & Departure
- PaxMAN Passenger Flow

Integration

Results
Major contribution to Air2Air:

- Advanced taxi time calculation
- Pre-departure-, off-block and taxi-sequencing
- Automated guidance – “follow the green”
- Situational Awareness
SMAN Decision Support Features

- Taxi Sequencing
- What-if Alternative Routing
- Aircraft Ground Movement Map
- Pre-Departure Sequencer
- Follow the Green

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Major contribution to Air2Air:

- **Arrival Manager (AMAN)**
- **Surface Manager**
- **Turnaround Manager (TMAN)**
- **Surface Manager**
- **Departure Manager (DMAN)**

**Performance Prediction**

- **Approach**
- **Landing**
- **Taxi**
- **Stand**
- **Taxi**
- **Take-off**

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Motivation

Air2Air Steering
- TMAN Turnaround Manager
- SMAN Surface Manager
- A/DMAN Arrival & Departure

Integration

Results

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Air2Air - Initial Architecture

External Sources Integration

- Actual Take-off Time
- Advanced Surface Management Guidance & Control System
- Feedback from Resources
- Calculated Take-off Time

PaxMAN

- Estimated/Actual Take-off Time
- Estimated/Actual Block Time
- Actual Take-off Time
- Actual Landing Time
- Actual Ready Time
- Target Take-off Time
- Target Start Approval Time

AMAN
SMAN
TMAN
SMAN
DMAN

AODB/Platform

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Motivation

Air2Air Steering

- TMAN Turnaround Manager
- SMAN Surface Manager
- A/DMAN Arrival & Departure Integration

Results
Air2Air - Process Chain

ETA input (ETFMS Data)  →  FIR entry →  STO (IAF) →  STA

Step 0: TOBT Prediction (based on ETA&TMAN)

Step 1: Demand Prediction (based on ETA & TOBT input)

Step 2: Pre-Dep. Sequencing (considering given DEP cap.)

Step 3: ARR Sequencing (departure gaps if required)

Step 4: ARR/DEP Sequencing (coordinated RWY sequence)

Departure

TOBT input (Airport CDM) → TSAT issue → TSAT → TTOT

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Integrated Steering at Capacity Limits

Shift Workload

Holding

Arrival Management  Surface Mgmt  Turnaround Management  Surface Mgmt  Departure Management
First Evaluation Results

• **42% improved airline ground handling punctuality** by TMAN
  - measured and reported effects at KLM in Schiphol

• **26% improved airport departure punctuality** at the R&D Project Airport
  (integration of A/DMAN-SMAN-TMAN-PAXMAN)

• **12% saved engine run time after off-block** at the R&D Project Airport
  (integration of A/DMAN-SMAN-TMAN-PAXMAN)

• **21% saved waiting time between end of taxiing and take-off** at the R&D Project Airport
  (integration of A/DMAN-SMAN-TMAN-PAXMAN)

• **62% of formerly denied passengers successfully boarded in a bottle-neck situation** at
  the R&D Project Airport (integration of A/DMAN-SMAN-TMAN-PAXMAN)

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A dynamical steering capability between NASP, Airport and AO has become possible.
Air2Air - 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 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

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Air2Air - Joint What-If

Arrival and Departure Manager Live&What-if

Turn Around Manager Live&What-if

Surface Manager Live&What-if

Scenario AODB

Live AODB

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Air2Air - Optimized Sequence for APOC/OCC

Feasible Optimized Air2Air Sequence

Optimization Parameters

- Revenue
- Connectivity
- Delay Cost
- Recovery Cost
- Resources Availability
- TOBT

Possibility Window
Fair Distribution

ARR/DEP Sequencing (coordinated RWY sequence)

Pre-Dep. Sequencing (considering given DEP cap.)

Hub Monitoring and Steering

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Air2Air - OCC Decision Support
Air2Air - OCC Decision Support

- Integrated Optimization
  - Priority Flights versus
  - Critical Flights

- Based on Actual ATC Feasibility Time Windows
- Revenue
- Cost
- Connectivity
- Resource Availability

Operations Control Center (OCC)

Priority Flights List vs Critical Flights List

Hub Control HCC A
Hub Control HCC B
Hub Control HCC C
Hub Control HCC D

Leg 1 Leg 2 Leg 3 Leg 4 Leg 5
Let's think about it