Ramp of the Future

Graeme Dewdney, Manager Global Airside & Standards, DHL Aviation
Christian Hen, Chief Customer Officer, Assaia International AG
Lars Mehrtens, Project Manager, Fraunhofer

Moderator: Massimo Cicetti, Manager Ground Operations Standards & Safety, IATA

IGHC 2019

IATA GROUND HANDLING CONFERENCE

IATA MADRID, SPAIN | 26-29 MAY
Aircraft Load Control Data

- In-Hold Loading System
- Valid ULDs
  - Structural Weight Limitations
  - Cabin Layout
  - Fuel System
- Centre of Gravity Limits
- Ops Data (Pantry, Crew etc)
- Dangerous Goods & Special Load
Airline Weight & Balance Engineer

Airline DCS Data Analyst

Load Control

... the process today

DCS Database
- System 1

DCS Database
- System 2

DCS Database
- System 3

AHM565
Paper standard

P2
... and the safety issues

- Quality often poor
- Version control often missing
- All agents complete data using their formats/styles
- Distribution methods inconsistent
- Document delivery can be slow

AHM565 Paper standard
... and the safety issues
Please clarify the Hold Maximum Weights in your AHM565 version 6

Actually, use version 3, for the Hold Max Weights
Flight Safety Risk

Updated data is sometimes difficult to identify on a revised AHM565 document.

All Flight Safety critical operational aircraft data MUST be managed under a quality system.

Although Manufacturer's Aircraft Manuals are very closely controlled, in many cases the extracted (AHM565) data is not.
Key Findings and Recommendations:

- A number of accident and incident investigations have revealed several instances where inaccurate basic operating weight was entered into the weight and balance software program. Errors of this type could have serious ramifications.

  **Recommended Action:** Part 135 certificate holders should review Advisory Circular 120-27E, as amended, and conduct a review of their weight and balance procedures to ensure that the persons responsible for the weight and balance calculations are:

  - Provided with current and correct aircraft weight and balance information, and
  - Verifying pre-loaded information in weight and balance software programs is correct prior to use.
.....how to mitigate the risk
....moving from this
....to this

Airline Weight & Balance Engineer

Airline DCS Data Analyst

Load Control

- CG Envelope Design
- Operational Curtailments
- Fuelling (Wt/Index) Tables
- Refuelling Sequencing
- Cargo Hold Max Weights
- Hold Locking Configurations
- Maximum Cargo Weights
- Cumulative Load Limitations
- Linear Load Limitations
- Lateral Imbalance Limitations
- Stabiliser Trim Setting Tables
- Passenger Seating
- Flight / Cabin Crew Locations
- Galley & Cabin Locations
- Crew Weight/Distribution
- Standard Pax & Bag Weights
- Water Wt & Distribution
- Service Weight Adjustments
- Aircraft Starting Weight/IU
- Maximum Operating Weights
- Valid ULDs
- CG Reference & IU Constants
....to this

---

**Airline Weight & Balance Engineer**

- Airline Wt & Bal Engineer
- Aircraft LOPA Diagrams
- CG Envelope Design
- Operational Curtailments
- Fuelling (Wt/Index) Tables
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---

**Load Control**

With IATA Standard XML Data File

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**Aircraft Manufacturer**

- DCS Database 1
- DCS Database 2
- DCS Database 3

---

**DCS**

- Database 1
- Database 2
- Database 3

---

**Airline Weight & Balance Engineer**

- Airline Wt & Bal Engineer
- Aircraft LOPA Diagrams
- With IATA Standard XML Data File
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---
Inoperative Locks
Inoperative Locks

> All Locks Operative = 4600KG
ONE Lock Inoperative = 2000KG
TWO Locks Inoperative = 0KG

Aircraft W&B Information Centre

DCS Database
- System 1
DCS Database
- System 2
DCS Database
- System 3
Electronic Flightbag
Electronic Flightbag
Switch between centralized DCS and onboard EFB
Electronic Flightbag

Manage aircraft transfers

Airline A

DCS

DCS

DCS

DCS Database

Airline B

IATA Aircraft W&B Information Centre

Load Control
Ground Handling

An UNPREDICTABLE business
An **UNPREDICTABLE** business is often a challenge to get DCS up and running at Short Notice.

<table>
<thead>
<tr>
<th>TIME</th>
<th>DESTINATION</th>
<th>FLIGHT</th>
<th>GATE</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:55</td>
<td>LONDON</td>
<td>TK194</td>
<td>11</td>
<td>BOARDING</td>
</tr>
<tr>
<td>10:00</td>
<td>NEW YORK</td>
<td>DH250</td>
<td>10</td>
<td>BOARDING</td>
</tr>
<tr>
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<td>SYDNEY</td>
<td>XF721</td>
<td>05</td>
<td>BOARDING</td>
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<tr>
<td>11:30</td>
<td>HONG KONG</td>
<td>SD581</td>
<td>32</td>
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</tr>
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</tr>
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</tr>
<tr>
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<td>HANOI</td>
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OUTAGE!

IATA Aircraft W&B Information Centre

Alternate DCS Provider

DCS

DCS

DEPARTURES

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Thank You
Ramp of the Future

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Moderator: Massimo Cicetti, Manager Ground Operations Standards & Safety, IATA
THE APRON AI

assaia

Member Working Group
Ramp of the Future
Finalist
IATA IGHC Innovator Award
Winner
AAAE Airport Innovation Forum
Shortlist
Technological Solution of the Year
Christiaan Hen

Amsterdam Airport Schiphol

- Advisor Airport Development & Innovation
- Operations Manager
- Head of Innovation

Assaia International

- Chief Customer Officer
COMMERCIAL AIR TRAVEL INDUSTRY: 2018

Total industry revenue: $821bn
Net profit margin: 3.9%
Industry net profit: $32bn

Cost of ground-related delays: $6bn = 19% of industry net profit
Cost of ground damages: $12bn = 38% of industry net profit

Industry profit could be 57% higher, were it not for delays and damages on the ground.

ENORMOUS GROWTH

2017 → 2037

Number of commercial aircraft in operation to increase by ~110%

+48,000 aircraft

industry-wide incremental revenue $500bn

Sources: Airbus Global Market Forecast, Boeing Commercial Market Outlook.
<table>
<thead>
<tr>
<th>flights not accommodated</th>
<th>demand not served</th>
<th>delays will cause an additional</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.7M</td>
<td>18%</td>
<td>52,500</td>
</tr>
<tr>
<td>per year</td>
<td>of passengers</td>
<td>human years wasted, per year</td>
</tr>
</tbody>
</table>

Source: Eurocontrol
PROBLEM

TURNAROUNDS = BLACKBOX

Poor data availability materializes in

degraded OTP
suboptimal asset utilization
excess cost
unattributed incidents
OUR MISSION

To ensure time-efficient and affordable air travel for the next decades by making apron operations more efficient, safer and more sustainable.
OUR SOLUTION

We feed ramp video* to AI to understand every turnaround and prevent incidents.
Automated vs manual data collection

<table>
<thead>
<tr>
<th>Before</th>
<th>60% of all data captured with a delay of &gt;2 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>After</td>
<td>100% of all data captured with a delay of &lt;15 sec</td>
</tr>
</tbody>
</table>
Giving your employees super powers

before 1 turnaround/coordinator

after 3 turnarounds/coordinator
In God we trust; all others bring data.

W. Edwards Deming
Raw data allows for historical analysis

<table>
<thead>
<tr>
<th>ID</th>
<th>Type</th>
<th>Timestamp</th>
<th>Detection timestamp</th>
<th>Detection gap (ms)</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>3652</td>
<td>Pushback tug left stand</td>
<td>06/12/2018 16:41:31</td>
<td>06/12/2018 16:41:36</td>
<td>4999</td>
<td>97%</td>
</tr>
<tr>
<td>3650</td>
<td>Pushback started</td>
<td>06/12/2018 16:40:40</td>
<td>06/12/2018 16:40:46</td>
<td>6192</td>
<td>100%</td>
</tr>
<tr>
<td>3649</td>
<td>Pushback tug connected</td>
<td>06/12/2018 16:31:09</td>
<td>06/12/2018 16:31:16</td>
<td>7197</td>
<td>98%</td>
</tr>
<tr>
<td>3648</td>
<td>Ground power disconnected</td>
<td>06/12/2018 16:30:03</td>
<td>06/12/2018 16:30:21</td>
<td>17605</td>
<td>99%</td>
</tr>
<tr>
<td>3647</td>
<td>Pushback tug entered stand</td>
<td>06/12/2018 16:29:15</td>
<td>06/12/2018 16:29:26</td>
<td>11323</td>
<td>99%</td>
</tr>
<tr>
<td>3646</td>
<td>Aft cargo door closed</td>
<td>06/12/2018 16:27:46</td>
<td>06/12/2018 16:27:51</td>
<td>5124</td>
<td>99%</td>
</tr>
<tr>
<td>3645</td>
<td>Bridge disconnected</td>
<td>06/12/2018 16:27:04</td>
<td>06/12/2018 16:27:17</td>
<td>12998</td>
<td>100%</td>
</tr>
<tr>
<td>3641</td>
<td>Aft cargo door open</td>
<td>06/12/2018 16:21:09</td>
<td>06/12/2018 16:21:21</td>
<td>11322</td>
<td>99%</td>
</tr>
</tbody>
</table>
Find potential for optimization
OBT predictions easily beat manual TOBT times

| AOBT estimation error, **15 minutes before** the plane is actually off-block | Percentage of turnarounds where the system’s estimate is within the error |
|---|---|---|
| | Our system | TOBT |
| ±3 min | 38.1% | 29.7% |
| ±5 min | 58% | 49.2% |
| ±8 min | 76% | 68.5% |
| ±10 min | 82.2% | 76.7% |
| ±15 min | 89.5% | 87.2% |
DATA PRIVACY & SECURITY

- Automatic and irreversible blurring of people
  - On premise video processing
- Structured data travels encrypted (SSL)
  - Strong authentication
  - Data not stored abroad
- ISO 27001, 27017, 27018 certified backend
DATA QUALITY

Each data point comes with a confidence value to ensure that unreliable data is disregarded.

**Latency**
After the event has happened, the time it takes until notification.

**Time error**
The inaccuracy of the reported timestamp

**Detection error**
Event happened, but was not detected ("false negative"). Event did not happen, but was detected ("false positive").
OUR CUSTOMERS

Airports

- YOUR LONDON AIRPORT
- Toronto Pearson
- FINAVIA
- EuroAirport

+ 15 more

Airlines

- BRITISH AIRWAYS

+ 7 more

Handlers

- swissport

+ 1 more

assaia
OUR ECOSYSTEM

Software

Video acquisition

Recognized

assaia
VISIT OUR ONLINE DEMO:

www.assaia.com/tmc

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Chief Customer Officer
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E-mail: christiaan.hen@assaia.co
Ramp of the Future

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Picture of the Future - Aviation Logistics
Opportunities in Ground Handling

IATA IGHC – Fraunhofer IML

Madrid, 2019/05/27
100% LOGISTICS

290 employees

250 post grad students and student assistants

30.7 million turnover, 50% of which from industry and commerce

Prof. Dr. Michael Henke
100% Management
Processes | Organisation

Prof. Dr. Dr. h. c. Michael ten Hompel
100% Technology
Hardware | Software

Prof. Dr. Uwe Clausen
100% Mobility
Humans | Goods
How we work

We do research…
… in-house and industrial contract research

We support…
… companies of all sizes and from all industries

We develop…
… e.g. for the LHC accelerator at CERN, Geneva
Changes in Air Cargo Handling?
Changes on the Ramp?

70s

Today
Picture of the Future
Current research along the process chain
Smart AirCargo Trailer

Motivation:
- Demand-oriented transport – PULL instead of PUSH principle
- Better usage of data between stakeholders

Targets:
- Improved capacity utilization
- Increased connectivity & data exchange between forwarders and Handling Agents
- Avoidance of backlogs

- Increased ramp efficiency an freight handling
Augmented Reality in Air Cargo Handling

1. Training
   - Contour
   - Pile factor
   - Mixed-load prohibition
   - Pallet weight and balance

2. Contour check
   - Database for contours

3. Build-Up
   - 3D scan of pieces
   - Software
AR and AI supported ULD Build-Up

Camera Sensor with Artificial Intelligence
- Recognition of:
  - Shape
  - Hull geometry
  - Structure
  - Properties (hard/ flexible)
  - Weight
  - Condition
  - Content
  - Combinability

HoloLens
- Tasks:
  - Identify parcels in open space
  - AR markings

KI Puzzle
- ULD build up

Database
- Records:
  - Destination
  - Time
  - Properties

Data flow

© Fraunhofer IML
AI Stowage pattern optimization

Packing pattern software Puzzle
1. Pre-calculation and optimization in load planning
2. Exercise tool for the qualification of specialists
3. Visual support of manual activities
4. Automation: Packing pattern optimization for robots

Features in preparation:
- Use of 3D scanners for individual contour detection of an article
- Optimization for containers and other load carriers

Effects of AR on the ULD Build-Up:
- Faster contour check via AR
- Faster assembly of ULDs via AR
Scannen: Feder
ULD Handling with AR

- Paperless ULD Handling
- Faster identification of “no-Show” luggage
Ramp of the Future: Automated Baggage Handling concept
Ramp of the Future: Automated Baggage Handling concept

Further challenges:
- Cargo Handling
- Special & Oversized Luggage
- Securing & Netting
„We AR ready!“
CONTACT

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WWW.IML.FRAUNHOFER.DE