Passenger-centric Intermodal Traffic Management involving Airports and Railways

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Research Areas

• Aeronautics
• Space Research and Technology
• Transport
• Energy
• Defence and Security
• Space Administration
• Project Management Agency
Challenges in Transport

- Achieving sustainable mobility with balance between
  - economy
  - society
  - ecology

by
- ensuring the mobility of people and goods
- protecting the environment and resources
- improving safety
# Portfolio of Transport

## Transport Research Area
Mobility, environment, safety, economy

<table>
<thead>
<tr>
<th>Terrestrial vehicles</th>
<th>Traffic management</th>
<th>Transport systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Road vehicles</td>
<td>• Road traffic management</td>
<td></td>
</tr>
<tr>
<td>• Rail vehicles</td>
<td>• Rail traffic management</td>
<td></td>
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<tr>
<td></td>
<td>• Airport management</td>
<td></td>
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<tr>
<td></td>
<td>• Sea traffic management</td>
<td></td>
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<tr>
<td></td>
<td>• Traffic management for major events and disasters</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Transport development and the environment</td>
<td></td>
</tr>
</tbody>
</table>
Intermodal airport management with passenger trajectories

- Project Optimode + Optimode.net
- Collaborative Decision Making CDM
- Multimodal Control Centre MCC
- Key Performance Indicators driven management
- Door-to Door (D2D) - oriented operational re-scheduling
Intermodal airport management
State of the Art: A-CDM
Source: Eurocontrol

INBOUND
- Data coherency check
- FIR Entry/Local ATC
- Taxi In (EXIT)
- ALDT
- ATOT
- -2hrs CTOT allocation
- -3hrs Flight Plan activation (FPL)
- Take Off from outstation
- Final Approach

TURN ROUND
- MTTT Minimum Turn Round Times will be in the CDM platform and can be updated by AO/AGH
- Boarding
- ARDT
- ASRT
- ASAT
- Taxi Out (EXIT)
- Final update of TOBT
- ATC issues TSAT
- 7/8
- 9
- 10
- 12
- 13
- 14

OUTBOUND
- Boarding
- ATOT
- 16
- 15
- AOBT
- 14
- Start up request
- 13
- Start up approved
- 12
- Aircraft ready
- 11
- Boarding starts
- 10
- TSAT issue
- 9
- TOBT update prior to TSAT
- 8
- Ground handling starts
- 7
- In-block
- 6
- Landing
- 5
- Final approach
- 4
- Local radar update
- 3
- Take off from outstation
- 2
- FORT – 2 hr
- 1
- ATC Flight Plan activation

CDM Milestones
Intermodal airport management
State of the Art, next step: TAM
Source: Eurocontrol, DLR

- **Total Airport Management**
  (Performance based Airport Management)
Intermodal airport management as part of ITS (Intelligent transportation system)

- Customer-centric approach
- Passenger information
- Stakeholder information
- Passenger’s preferences and choices
- Infrastructure and schedules adoption
- Airport fully embedded in main catchment area
- Link between service provider, infrastructure provider, and customer
- Digitalized reality
Intermodal airport management
Use case example 1

• LATE COMMUTING PASSENGERS
Intermodal airport management
Use case example 2

• GATE CHANGE
  • Revenue optimised gate re-assignment
  • Arriving / departing passengers (separated shopping experience/offers)
  • Estimated willingness to buy, depending on availability, dwell time, and of course on the ability to pay – optimisation task!
Intermodal airport management
Passenger trajectory

- Scheduled, calculated, estimated, and actual tasks
- Standardisation is the key to reduce development efforts to include additional partners and stakeholders

<table>
<thead>
<tr>
<th>Task station</th>
</tr>
</thead>
<tbody>
<tr>
<td>(point in time &amp; event)</td>
</tr>
<tr>
<td>OPAT Outbound Passenger at Airport Entrance Time</td>
</tr>
<tr>
<td>OPCT Outbound Passenger at Checkin Time</td>
</tr>
<tr>
<td>OCCT Outbound Checked at Checkin Time</td>
</tr>
<tr>
<td>OPST Outbound Passenger at Security Time</td>
</tr>
<tr>
<td>OCST Outbound Checked at Security Time</td>
</tr>
<tr>
<td>OPET Outbound Passenger at Emigration Time</td>
</tr>
<tr>
<td>OCET Outbound Checked at Emigration Time</td>
</tr>
<tr>
<td>OPGT Outbound Passenger at Gate Time</td>
</tr>
<tr>
<td>OCGT Outbound Checked at Gate Time</td>
</tr>
</tbody>
</table>
Intermodal airport management
Customized information broadcasting

- Optimode.app
Intermodal airport management
Customized information broadcasting

- Optimode.app

<table>
<thead>
<tr>
<th>No.</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I think I would like to use this system frequently.</td>
</tr>
<tr>
<td>2</td>
<td>I found this system unnecessarily complex.</td>
</tr>
<tr>
<td>3</td>
<td>I think the system was easy to use.</td>
</tr>
<tr>
<td>4</td>
<td>I think I would need the support of a technical person to use this system.</td>
</tr>
<tr>
<td>5</td>
<td>I found the various functions of this system well integrated.</td>
</tr>
<tr>
<td>6</td>
<td>I found there was too much inconsistency in the system.</td>
</tr>
<tr>
<td>7</td>
<td>I would image most people would learn to use this system very quickly.</td>
</tr>
<tr>
<td>8</td>
<td>I found the system very cumbersome to use.</td>
</tr>
<tr>
<td>9</td>
<td>I felt very confident using the system.</td>
</tr>
<tr>
<td>10</td>
<td>I needed to learn a lot of things before get going with this system.</td>
</tr>
</tbody>
</table>
Intermodal airport management
Customized information broadcasting

• Optimode.app
Intermodal airport management
Collaborative decision making (I)

- Pax_radar, full view
- Innovative human-machine-interface
- Situational awareness
- Passenger status
  - Check-In
  - Security
  - Boarding
Intermodal airport management
Collaborative decision making

(II)

• Pax_radar, detail one flight event

Check-In
Security
Boarding

Forecast feature: *When is boarding completed?*

Gate-Change feature

Tooltip feature

DE5958

Callsign : DE5958 : AGP | FRAN
Aircraft : A320 (-200)
Airline : CONDOR
Gate : Gate-A17 (Gate-A17)
Pax : 130 (105/121/45)
Transfer Pax : 0/0
SOBT: 08:10 EOBT: 08:10
5:30
5:37
7:43
7:43

all 121/130 Pax
Check In : 105 Pax
Security : 121 Pax
Boarding : 45 Pax

Time to Off-Block : 26 min
Forecast BS : 100% Last Pax : 07:05:21
Intermodal airport management
Collaborative decision making (III)

Gate as partition of circle

Radius =
time to departure (logarithm)
Intermodal airport management
Collaborative decision making
(IV)

- Passenger Trajectory Tool PETRA
  single flight view

Passenger status (nowcast + forecast hybrid)

- Pax already boarded to plane
- Pax with good connectivity
- Pax arriving at gate close to OBT
- Pax arriving the gate after OBT

50 100 150 ...

Pax per flight
Intermodal airport management
Collaborative decision making

(V)

Passenger Trajectory Tool PETRA
all flights view

1st flight

common problem identification
support

Pax already boarded to plane
Pax with good connectivity
Pax arriving at gate close to OBT
Pax arriving the gate after OBT

last flight

50 100 150 ...

Pax per flight
Optimode

Optimode addresses performance-based intermodal airport management as a modular toolsuite.
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