THE DECISION MODEL FOR AIRCRAFT STAND ALLOCATION
What do you know about airports?
What decisions are made to manage an airport?
What do we know about Schiphol?

- Passengers
- Transfers
- Flights
- Fright
- Handlers
- Finance
- Safety
- Remote handling
- On time performance
- Slots
- Runway
- Noise
- Layout
Strategy: close gap between strategy and execution

Relationship between policy & strategy, management & tactics and operation & execution.
Strategy: rule based approach for traffic management

Less rules, simple rules, small units, data driven, agent based control mechanism, optimize flow, goal variable.

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Question

"Why are there so many gate changes?"
Is a gate change an optimization or a disruption?

50-100 gate changes per day 1 hour before arrival.
Silvie in the control tower

Day shift

Morning shift

Night shift
The day ahead plan: same agents (same color tone) in adjacent ramp, airlines (same color) after each other, optimal turn over factor, maximal separation time.
NO IDEAL PLAN?

The day-ahead planning: Everything has a place...

Gate modification to avoid risk of waiting flight 2.

Flight 1 is delayed on departure.
Which aircraft stand is assigned to flight?

A. Should a flight be assigned to a gate?

B. Which gates may accommodate the flight?

C. Which gates are mandatory for flight?

D. Which gate or platform is agreed with airline?

E. Which gate has minimal distance to transfer gates?

F. Which gate will avoid the risk on future delays?

G. Which gate is closest to gates handled by the same agent?

Decision / sub decision

Dependency is a result of implementation decision in GMS

relevant criteria not in GMS

Criteria for decision

Decision / sub decision

Formal knowledge source (document or policy)

Human knowledge source

Citation for decision

Gate planners

Distance between gates / floorplan

# transfer, pax

Aircraft category / type

Airline

Flight number

Origin

Destination

Accountmanager airline

Clearing time + Separation time

Aircraft stand assignment
day ahead planning

Planned work

Flight type (K, W, unknown)

Regulation Aircraft Stand Allocation Schiphol

Aircraft category / type

Flight STA

# dep. pax

# transfer, pax

Schengen, EU, NEU

Lijst met bolletjes landen

tow

Categorie tabel vliegtuig type

AAS opstelplaatsentabelle I maatgeving

Which aircraft stands are available for flight?

G. Which gate is closest to gates handled by the same agent?
Based on October / November 2017 - data extracted from CISS

Aircraft stand update
(on day planning)

- Should the aircraft stand allocation be changed for a flight?
  - B. Assigned gate can accommodate the flight?
  - H. Assigned gate for arriving flight is available on EIBT?
  - I. Is the time between flights too short or overlaps?

- New flight registration
- New EIBT
- New TOBT
- Clearing time + separation time

- Percentage of flights that update the aircraft to a larger aircraft on the day of operations
- Percentage of flights that update the EIBT on the day of operation and may disturb the plan
- Percentage of flights that update the TOBT on the day of operation and may disturb the plan
- Percentage of flights that change gate due to another flight scheduled on the gate

Categories
- Categorie tabel vliegtuig type
- Schengen, EU, NEU
- Lijst met bolletjes landen
- Planned work

- AAS
- Opselplaatsetabe I maatgeving

- Percentage  of flights that update the aircraft to a larger aircraft on the day of operations
  - Category
  - Length

- Percentage of flights that update the EIBT on the day of operation and may disturb the plan
  - Rushhour
  - Season
  - Minutes

- Percentage of flights that update the TOBT on the day of operation and may disturb the plan
  - Rushhour
  - Season
  - Minutes

- Percentage of flights that change gate due to another flight scheduled on the gate
How to solve a capacity problem for an aircraft stand allocation?

J. Option to include pit stop?

K. Option to create a tow?

L. There is a holding position to wait for the assigned gate.

M. Option to switch flight of adjacent ramps

N. Option at other pier

O. Option to use bus gate

Promote outbound

Decrease inbound

Reroute

New aircraft stand (on day planning)
Objective: on time performance

All parties allow for some flexibility in the plan, consequently, the scheduled and actual times are never the same by design.
What does on time performance mean?

All parties allow for some flexibility in the plan, consequently, the scheduled and actual times are never the same by design.
Objective: optimize use of assets

Wide wing aircraft occupies three gates
The gate that is for a departing flight must have a waiting area capacity that is at least the number of departing passengers of the flight.

<table>
<thead>
<tr>
<th>#</th>
<th>Status</th>
<th>Rule</th>
<th>Condition</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cost</td>
<td>dep pax&gt;= 201</td>
<td>in</td>
<td>D41</td>
</tr>
<tr>
<td>2</td>
<td>Cost</td>
<td>dep pax&gt;= 201</td>
<td>in</td>
<td>E02</td>
</tr>
<tr>
<td>3</td>
<td>Cost</td>
<td>dep pax&gt;=275</td>
<td>in</td>
<td>D43, D47</td>
</tr>
<tr>
<td>4</td>
<td>Cost</td>
<td>dep pax&gt;= 300</td>
<td>in</td>
<td>F08</td>
</tr>
</tbody>
</table>
Strategy: decision model

B. Which ramps may accommodate a flight?

- Flight type (K, W, unknown)
- Airline
- Aircraft category / type
- # dep. pax
- tow

Planned work

Categorie tabel vliegtuig type

AAS opstelplaatsentabe I maatgeving
Strategy: deal with disruptions

Air capacity, ground capacity and terminal capacity are related
The capacity class for an asset is a real time indicator that shows how the usage of the capacity may influence on time performance.
Be radical transparent and adapt rules to minimize the consequence of disruptions when capacity is optimal used.
Is there one solution?

The capacity of different stakeholders in the chain is related and may all be the bottleneck at some point in time.
Measure capacity usage on links in the network

Example of capacity classes for different kinds of assets

The ramp situation is a capacity class for an occupied ramp based on the expected separation time with the following flight.

The pier situation is a capacity class for a pier based on the lowest number of alternative gates in the pier for the next planned flight allocation at each gate.

The aircraft stand allocation situation is a capacity class for an aircraft stand allocation based on the number of alternative gates available for the flight.

The holding position situation is a capacity class for Schiphol that indicates the total holding time of all aircrafts standing at a holding position.
Keep it simple

Be radical transparent and adapt rules to minimize the consequence of disruptions when capacity is optimal used.

<table>
<thead>
<tr>
<th>Capacity class:</th>
<th>Flexible</th>
<th>Saturation</th>
<th>Congestion</th>
<th>Grid lock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promote outbound?</td>
<td>-</td>
<td>Request</td>
<td>Request</td>
<td>Request</td>
</tr>
<tr>
<td>Limit inbound?</td>
<td>-</td>
<td>-</td>
<td>Request</td>
<td>Request</td>
</tr>
<tr>
<td>Reroute?</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Request</td>
</tr>
</tbody>
</table>
Small steps

Policy document is updated

RASAS

Regulation for Aircraft Stand Allocation Schiphol

https://www.schiphol.nl/en/operations/page/aircraft-process/
Small steps

- Less proza, less pages
- Follows the structure of the decision model
- Separate chapter for day ahead decisions and handling disruptions
- All guidelines expressed as constraints
- More decision tables

Example document for all other plan processes.

https://www.schiphol.nl/en/operations/page/aircraft-process/
### 5.3 General Aviation at Schiphol-East

Specific allocation criteria and specific security control requirements apply to flights from the General Aviation area at Schiphol-East due to the special security status of Apron K (non-SRA-CP).

<table>
<thead>
<tr>
<th>Qualification</th>
<th>Seats</th>
<th>Permission</th>
<th># per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Aviation</td>
<td>all</td>
<td>Always allowed</td>
<td>Not restricted</td>
</tr>
<tr>
<td>Passenger flight</td>
<td>&lt;20</td>
<td>Always allowed</td>
<td>Not restricted</td>
</tr>
<tr>
<td></td>
<td>20-50</td>
<td>Permission required by AAS</td>
<td>Max. 50 flights per year</td>
</tr>
<tr>
<td></td>
<td>&gt;= 50</td>
<td>Not allowed</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: allocation criteria apron K
5.1.3 Best fit
Flights are planned according to the 'best-fit' system. This means that aircraft will be allocated to the smallest possible stand available. Sometimes the waiting area in the terminal creates the bottleneck of the allocation.

Principle 3: The aircraft stand allocation plan should maximize the number of aircraft that are assigned to an aircraft stand of the same size.
Motivation: Most efficient use of the assets, being able to assign as many aircraft as possible to a pier gate.

Principle 4: The number of outbound passengers must not exceed the capacity of the pier gate waiting area.
Motivation: Comfort and safety for the waiting passengers.

5.1.4 Clustering
The aim is to cluster flights contracted with the same handling agent. In addition, flights operated by the same airline will be clustered where possible so as to streamline airline-related processes.

Principle 5: The aircraft stand allocation plan should maximize the number aircraft stand allocations whose neighbour is the same airline or handled by the same handler.
Motivation: Encourage punctuality in handling operations and to enable the handling agents to plan the deployment of human and material resources as efficiently as possible.
choose for AI and for explainability

Upcoming book
Explainable Artificial Intelligence Explained
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