FREQUENTIS
FOR A SAFER WORLD

# Integrated AMAN/DMAN/SMAN

**Implementation of ATM Automation System in APAC Region, 7th June 2022**

Gotthard Börger – Director Products and Strategy Frequentis Orthogon

# Presentation Agenda

- Introduction AMAN, DMAN
- Integrated AMAN/DMAN (IAD)
- SMAN (TowerPad®)
- Integrated AMAN/DMAN/SMAN (IADS)

# Introduction
# AMAN, DMAN

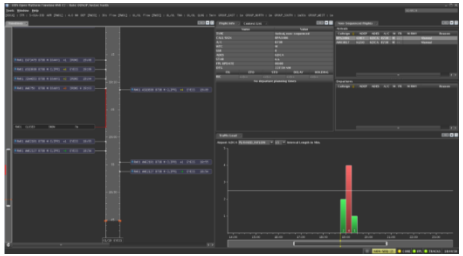
# Arrival Manager

## What it does

AMAN provides ATC assistance in metering and sequencing of dense and complex arrival streams to implement efficient arrival management. AMAN provides target times and the corresponding advices.

## Product Characteristics

- Worldwide, operationally proven (100+ years)
- Planning for highest controller acceptance
- Advisory trajectory to provide advanced functions
- E-AMAN/XMAN
- Supports RECAT-EU & TBS



## Benefits in Efficiency, Capacity, Predictability and Controller workload

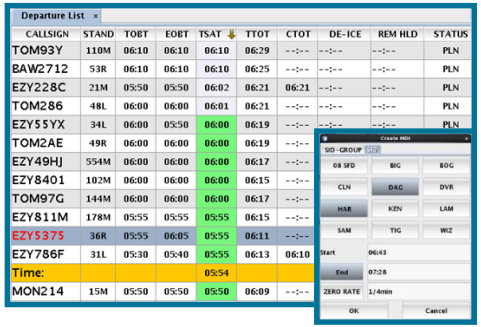
- Delay absorption at fuel-efficient altitudes
- Optimisation of the arrival sequence and runway throughput
- Metering of traffic from different en-route sectors to balance workload (no contradicting advices)
- Information sharing with partner ANSPs, ACCs, airport, airlines and cockpit crews

# Departure Manager

## What it does

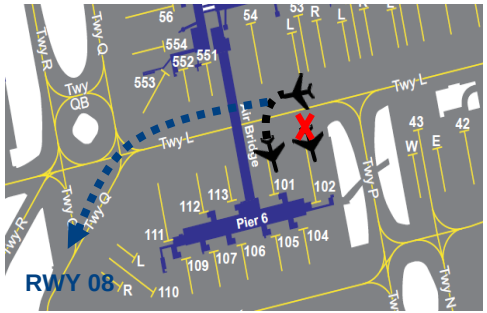
DMAN performs pre-departure Off-block and runway sequencing to support Air Traffic Control to maximise utilisation of available capacities.

DMAN contributes to A-CDM with synchronised PDS functionality




## Product Characteristics

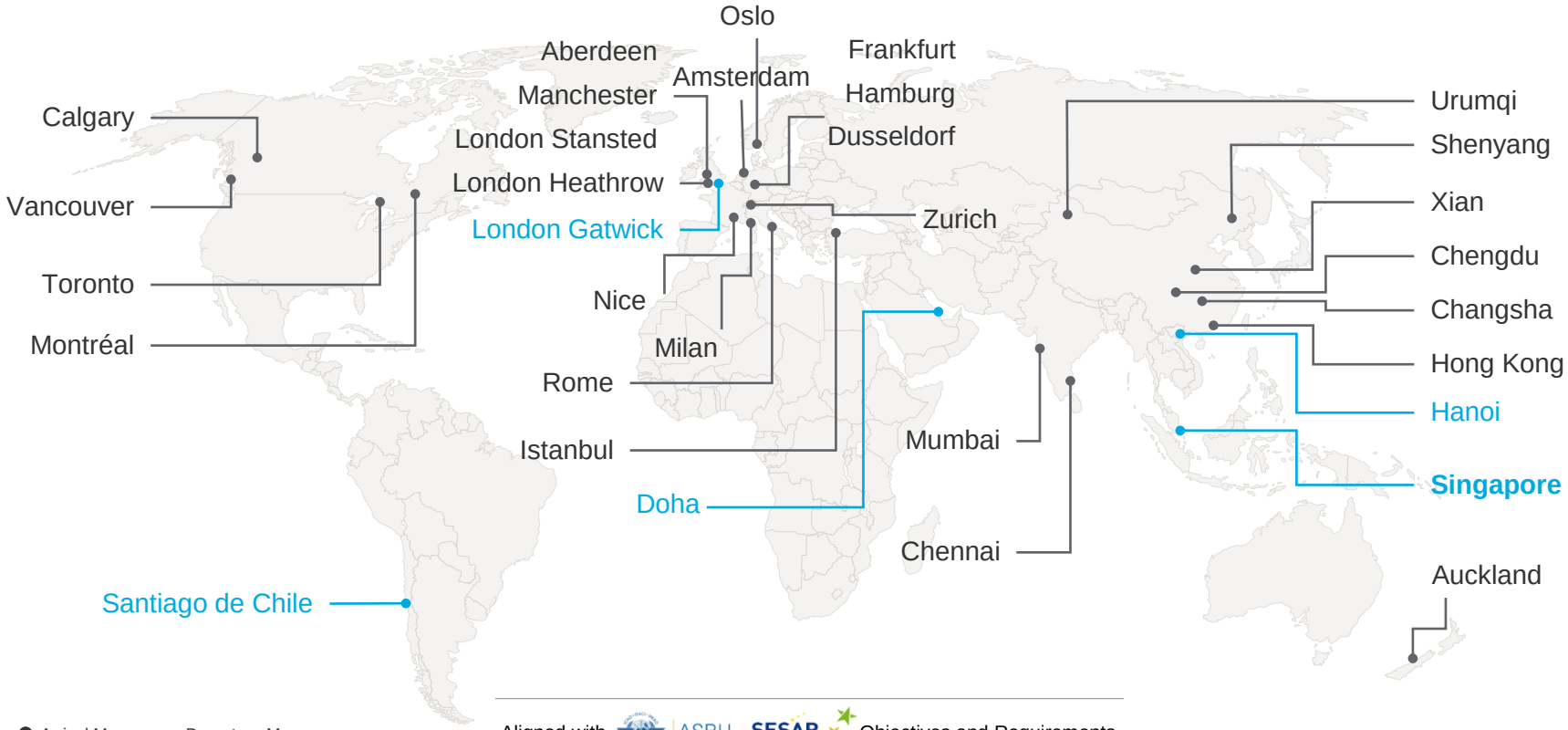
- Stand Contentions
- Remote Holding
- Optimal TTOT Calculation
- What-if capability
- Minimum Departure Intervals (MDI)
- Coupling with Electronic Flight Strips



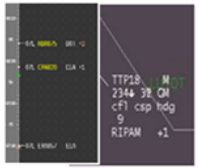

## Benefits

- Decrease fuel burn and emissions
- Better on-time performance
- Improved airline service
- More efficient resource planning
- Increased slot compliancy and capacity

# Traffic synchronisation: AMAN & DMAN references



# Traffic Synchronisation: Aligning with ICAO ASBUs (RSEQ Block 0-2)



## AMAN & Time Based Metering

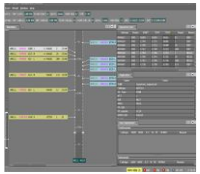
- Heathrow, Toronto, Singapore, Auckland, Hong Kong, Rome, Milano…
- B0-RSEQ

## Departure and Surface Integration

- Heathrow, Singapore
- B1-RSEQ

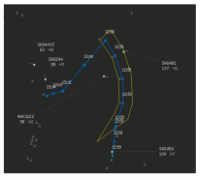
## Departure Management

- Gatwick, Singapore, Qatar, Frankfurt,...
- B0-RSEQ



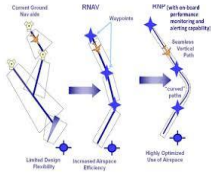
## Extended Arrival Metering

- Heathrow, Toronto, Gatwick, Istanbul, Zurich,…
- B1-RSEQ



## AMAN & Point Merge System

- Oslo, Istanbul
- B0-RSEQ




## Utilisation of RNP Routes

- Auckland, Calgary
- B1-RSEQ

### A-CDM

- DMAN and AMAN contributes to A-CDM

### WAKE

- RECAT-EU
- AMAN and TBS

### NOPS

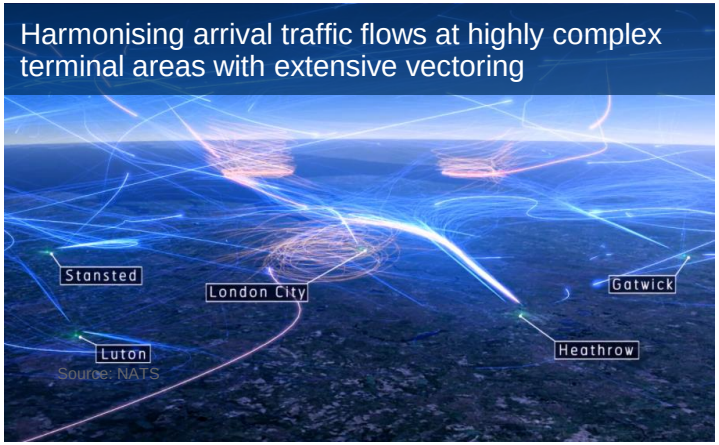
- AMAN and DMAN supporting ATFM

## Integrated Arrival and Departure Manager

- Singapore, Qatar, Santiago de Chile
- B2-RSEQ

# Integrated AMAN/DMAN

# Extended and cross-border arrival management: a world's first




**London**
E-AMAN & XMAN

**Zurich FABEC**
XMAN

**Toronto**
E-AMAN

**Significant reductions of fuel, emissions and noise** due to early delay absorption at higher altitudes

**More balanced demand & capacity** without impacting the overall duration of the flight

**Efficiency gains and reduced controller workload** due to the improved coordination of control centres

**8000t**
$CO_2$

**2,12M**
EUR in fuel

NATS

"With early warning of XMAN, even flights that slow down by 0.03 of Mach could save several minutes in the stack. That reduction in speed reduces fuel as well."

**Joe Baker, Project Lead at NATS**

- ✓ Extension of the AMAN planning horizon for early arrival management
- ✓ Use of additional data sources (e.g., ETFMS) for AMAN pre-sequencing
- ✓ Distribution of AMAN sequence via SWIM service to neighbouring control units



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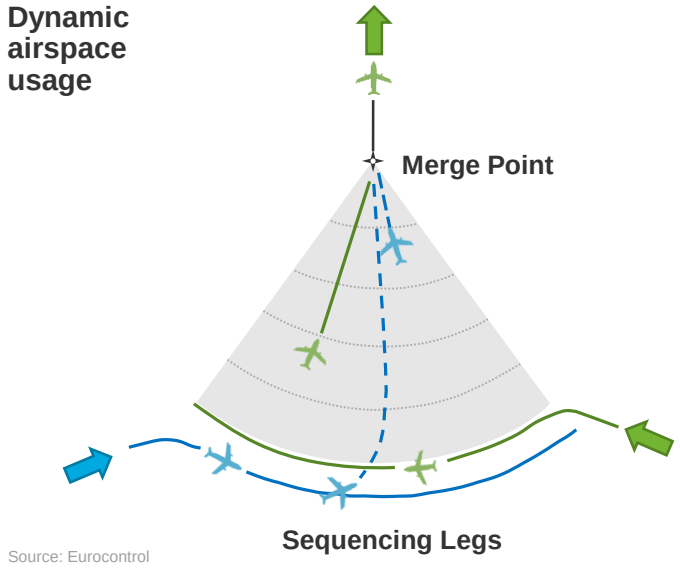
# Point Merge System: Innovative sequencing to simplify and enhance arrival operations




Source: Eurocontrol

| | | |
|---|---|---|
| **Worlds 1st** implementation in Oslo (Avinor) since 2011 | **Highly precise trajectory prediction** considering the PMS route structure | **Controller support** by AMAN distance-to-turn-point and turn advice |
| → Reduction of inefficient aircraft vectoring and additional track miles leads to less fuel consumption | → Standardi-sation of arrival trajectories improving predictability and situational awareness | → Increased efficiency & capacity to meet expected demand |

AVINOR

"PMS really helps us to further improve arrival and departure operations. We couldn't miss AMAN for a single day."

**Kristian Pjaaten, Avinor's AMAN Project Manager**



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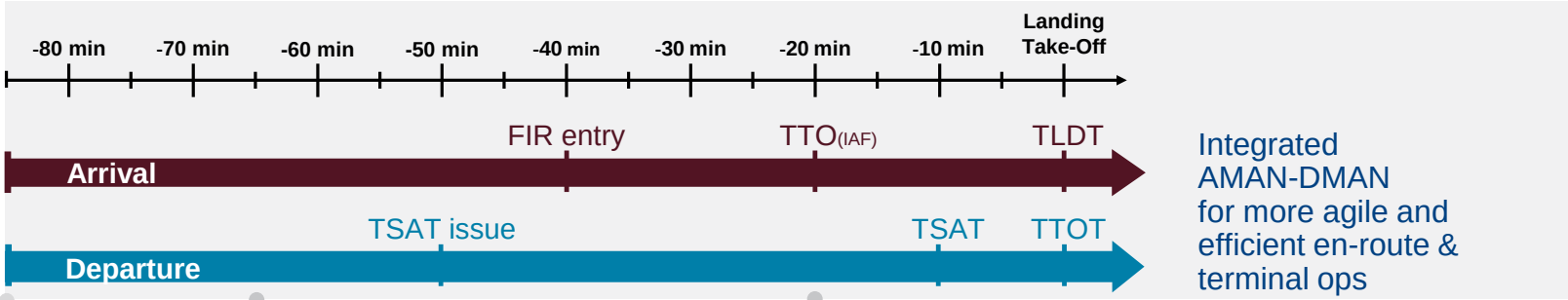
# Efficiency improvements for mixed-mode or dependent segregated runways




**ca. -20min**
- TLDTs stable – separation-based coupling

**ca. -60min to -70min**
Traffic volume (almost) complete
- Flow-based coupling – TWR/APP joint decision on pattern

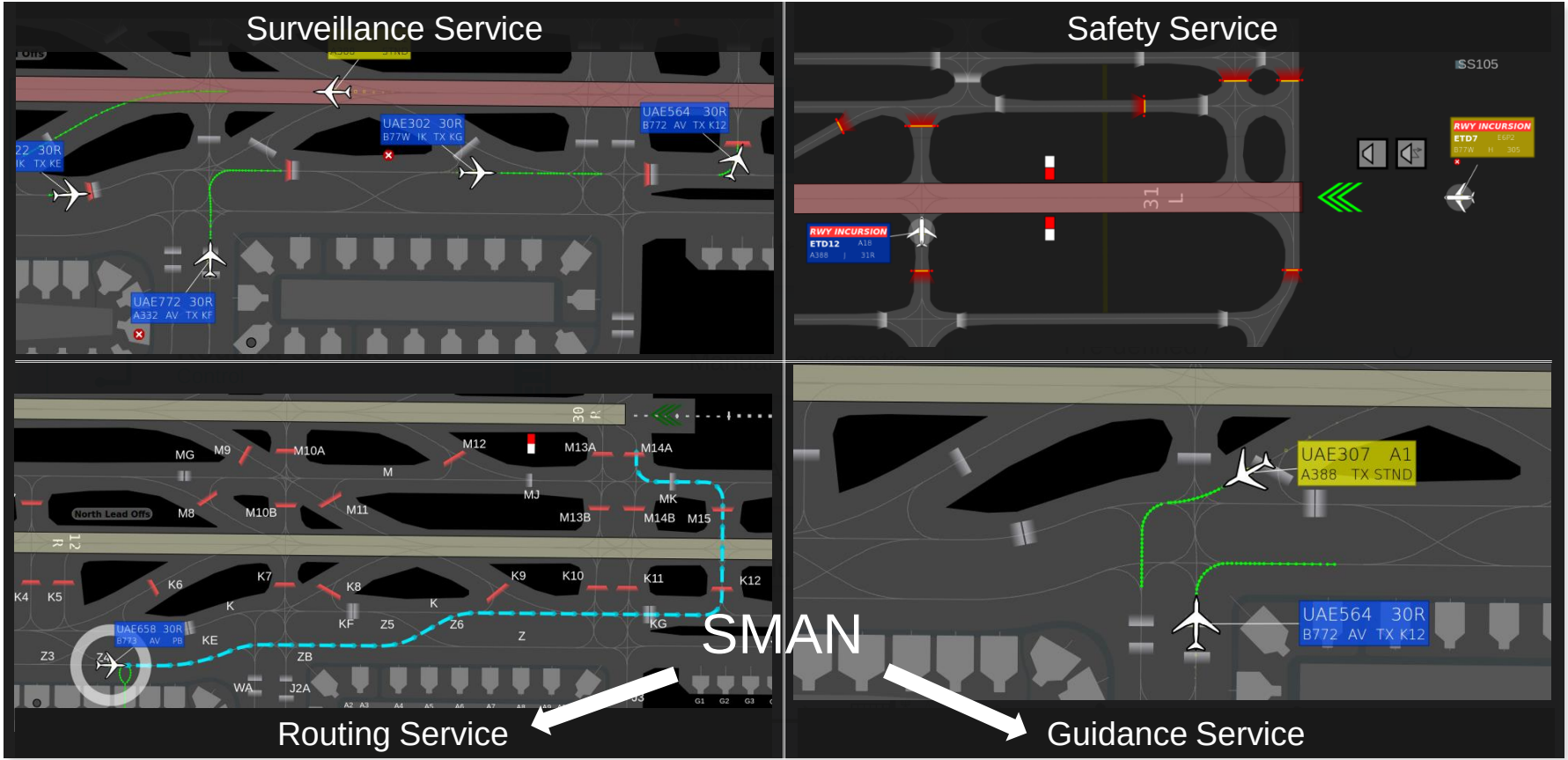
**ca. -85min**
DMAN and AMAN start planning
- Most TOBTs are available, but subject to change
- Not all arrivals are sequenced (e.g. short-hauls still on ground)

# Integrated AMAN/DMAN – Reference: CAA Singapore


| | | |
|---|---|---|
| → Enhanced productivity, sequence efficiency, and the ability to predict future traffic load | → Improved decision-making process especially for mixed-mode runways | → Heightened situational awareness and reduced controller workload |
| **Flexible runway allocation** depending on demand | **Dynamic runway balancing** to minimize ARR/DEP delay | → Reduced holdings (ground and air) contributes to the reduction of fuel burn for airlines |
| Timelines **combine information** on ARR/DEP sequence and runway mgmt. | **Predictive analysis**<br>Calculation of demands and capacities | IAD provides **full AMAN and DMAN capabilities** |

# SMAN
# (ATRiCS TowerPad®)

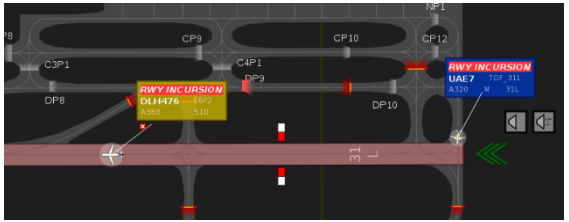
# A-SMGCS function blocks



# Airport Safety Support Service for uninterrupted continues operation

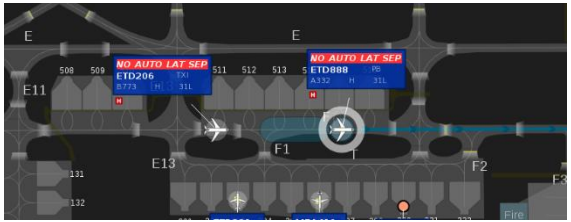
## Enabling controllers to prevent, detect and de-conflict hazardous situations and incidents

### Runway Monitoring and Conflict Alerting (RMCA)




- Runway Incursion Alarm
- Stop Bar Overrun Alarm
- Runway Highlighting
- Runway Occupancy List
- Constrained Area Alarm
- …
- Area intrusion alarms
- Wing-tip separation alarm

### Conflicting ATC Clearances (CATC)




- Lateral Separation Alert
- Push-back Alert
- Missing Hand-over Alarm
- Route Constraints Warning
- …

### Conformance Monitoring Alerts for Controllers (CMAC)


- Give-way-to Violation Alarm
- Holding position overrun alarm
- Route deviation alarm
- Route restriction warning
- Longitudinal spacing violation
- …

# Routing Service

Automatic and manual route management for all mobiles on the movement area

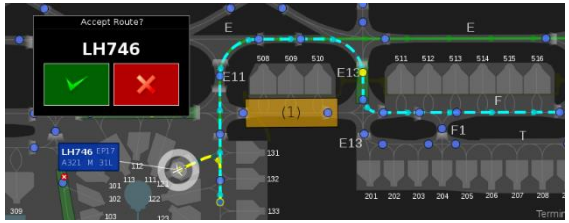
## Automatic Routing


- Automatic generation of routes based on aerodrome procedures and constraints such as:
  - type of aircraft
  - assigned runway or stand
  - restricted areas
  - configurable taxi route preferences and
  - constrained areas

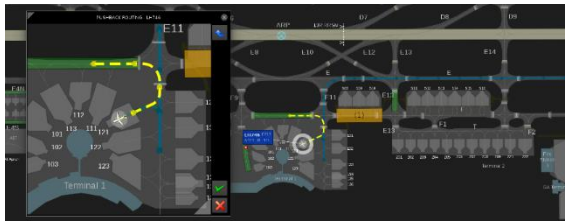
## Automatic Re-Routing Proposals


- Automatic detection of conflicts related to planned route
- Automatic proposed conflict resolution upon target selection

## Manual Routing



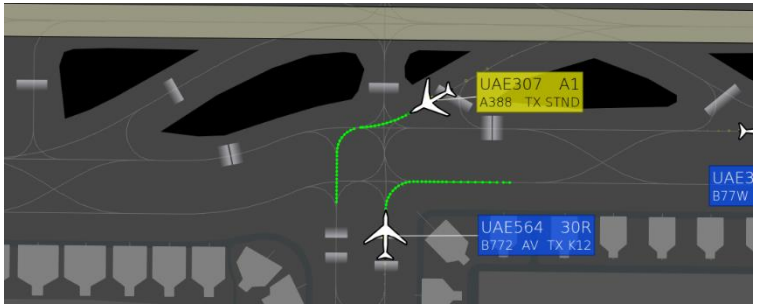

- Manual overwrite of proposed route
- Manual assignment of push-back part of the route if a non-standard push-back maneuver is required

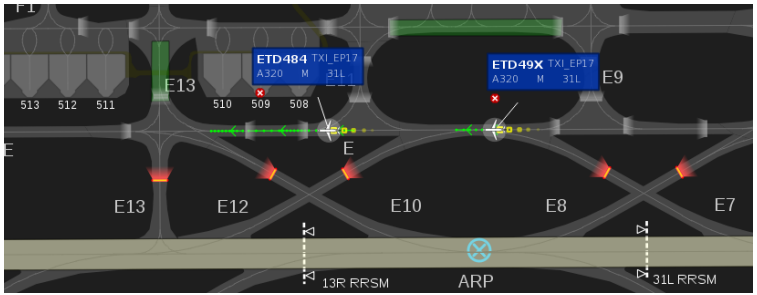


# Guidance Service

## Improving the flow of mobiles on the movement area

**…to fully automated follow-the-greens**




- providing:
  - improved guidance through unambiguous route presentation to pilots and controllers
  - increased safety
  - significantly reduced voice communication, frequency congestion and controller workload
  - reduced power consumption and longer lifetimes of airfield lights
  - automatic separation between mobiles through floating spacing

# Integrated AMAN/DMAN/SMAN

# Integrated AMAN/DMAN/SMAN - IADS

- Critical Resources IADS
  - IAD focus on airspace and runway constraints
    (metering at fixes, arrival route assignments, minimum departure interval, runway usage)
  - SMAN is focused on surface constraints

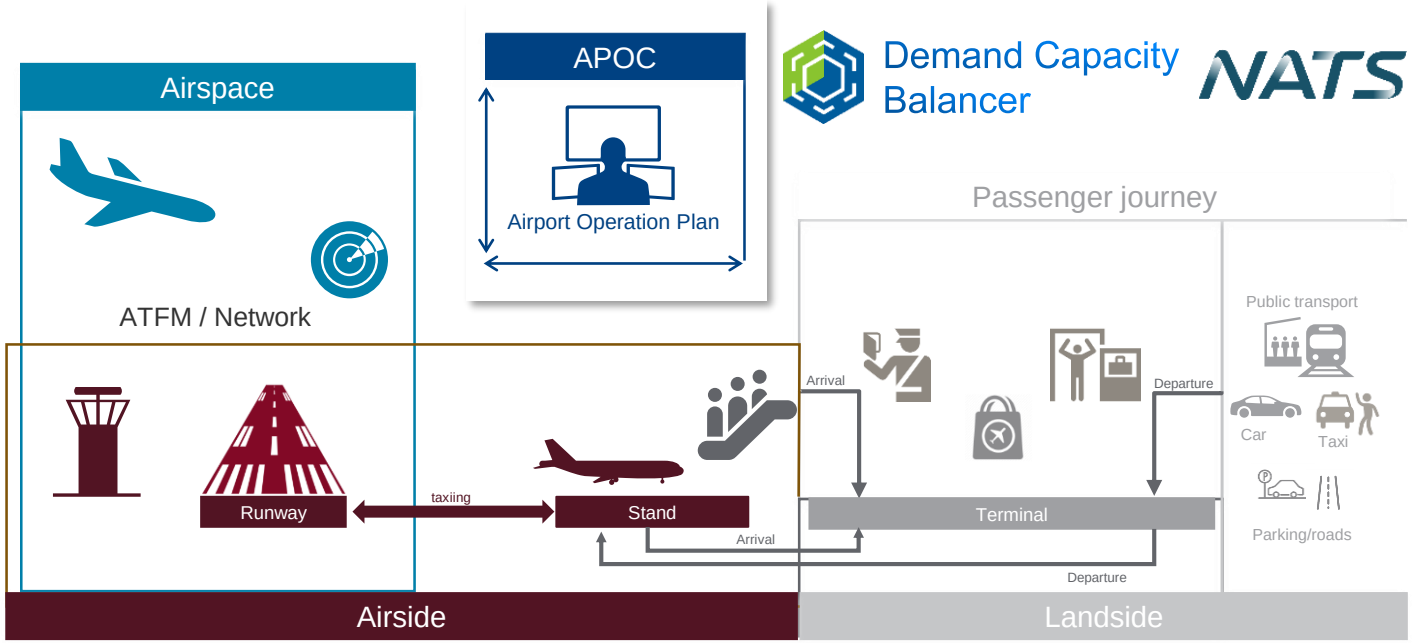
- IAD and SMAN will benefits from each other:
  - SMAN routing service allows DMAN to replace (A-CDM) VTTC (before off block)
  - Accurate AMAN landing time predictions (TLDT) used by SMAN to predict accurate in block times
  - If connected to AIM SMAN could consider routing restrictions (improvement compared to VTTC)
  - DMAN and SMAN need to share departure constraints to ensure synchronized optimization before and after off block – IAD and SMAN synchronization
  - SMAN considers (indirectly) airspace and runway constraints

**Integrated AMAN/DMAN/SMAN considers**

**airspace, runway and surface constraints consistently**

# Connecting IADS with Airport resource management systems

**Integrated AMAN/DMAN**




TowerPad®

ATRiCS
MAKE YOUR AIRPORT FLY





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# Thank you

# Reaching out to Frequentis


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