# MAESTRO Flow Sequencer in China

## AMAN, DMAN, E-AMAN

**22-23 Nov 2018**

# China Context

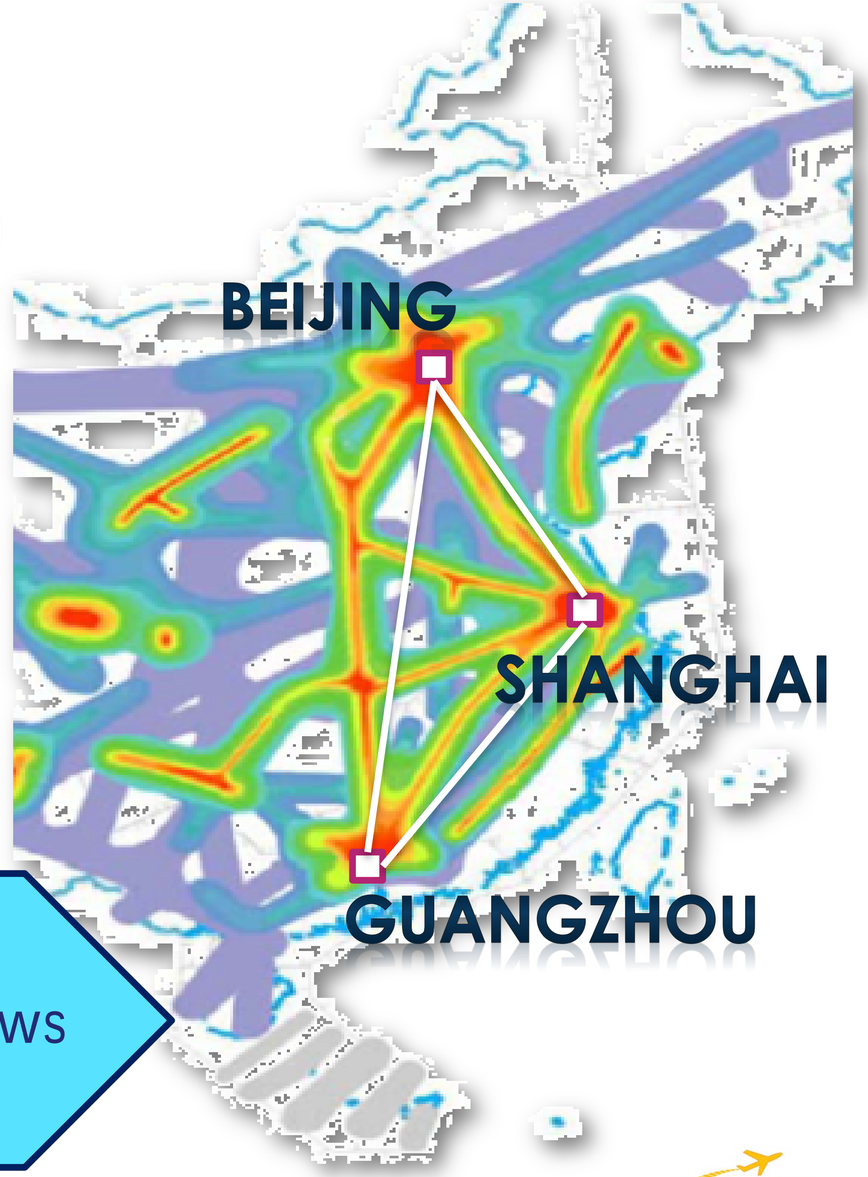
## Major Infrastructure Growth

- New major airports in already congested TMAs (Daxing airport)
- Existing airport extensions (additional runways)

## Keep increasing TMAs and airports capacity

- MAESTRO AMAN contracted for Shanghai, Beijing and Guangzhou TMAs
- MAESTRO DMAN contracted for Shanghai and Beijing airports

Maximise capacity benefits
Support controllers in sequencing complex traffic flows
Reduce delays

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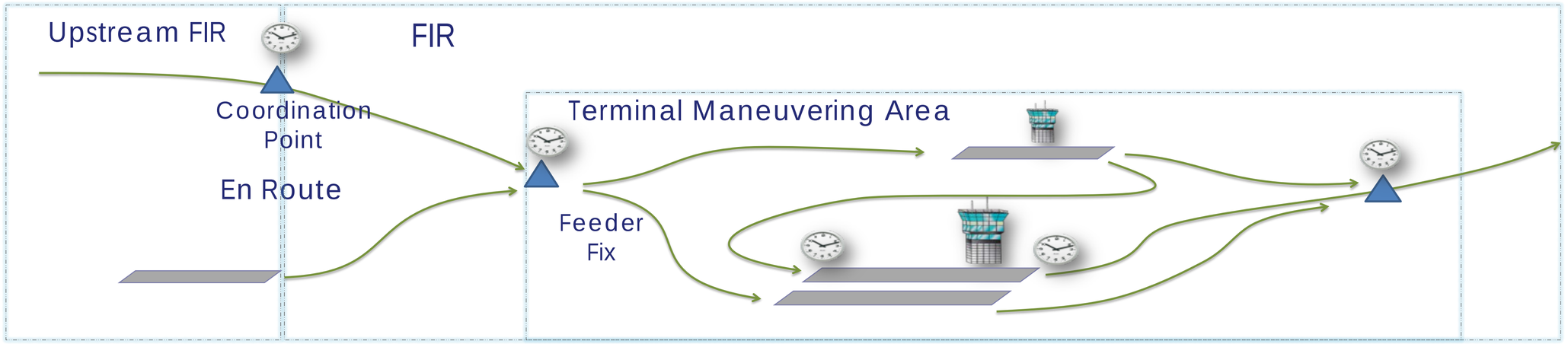
# Tactical Flow Management

## Vocabulary




**E-AMAN** | **AMAN** | **DMAN**

- **Cross border Arrival Metering** (E-AMAN)
- **Arrival scheduling at Runway, Feeder, Metering fix** (AMAN)
- **Airport Configuration** (AMAN)
- **Arrival / Departure Coupling** (AMAN)
- **Pre-sequence at the Block Take off sequence at runway** (DMAN)
- **Departure Metering (multi-rwy / airport** (DMAN)

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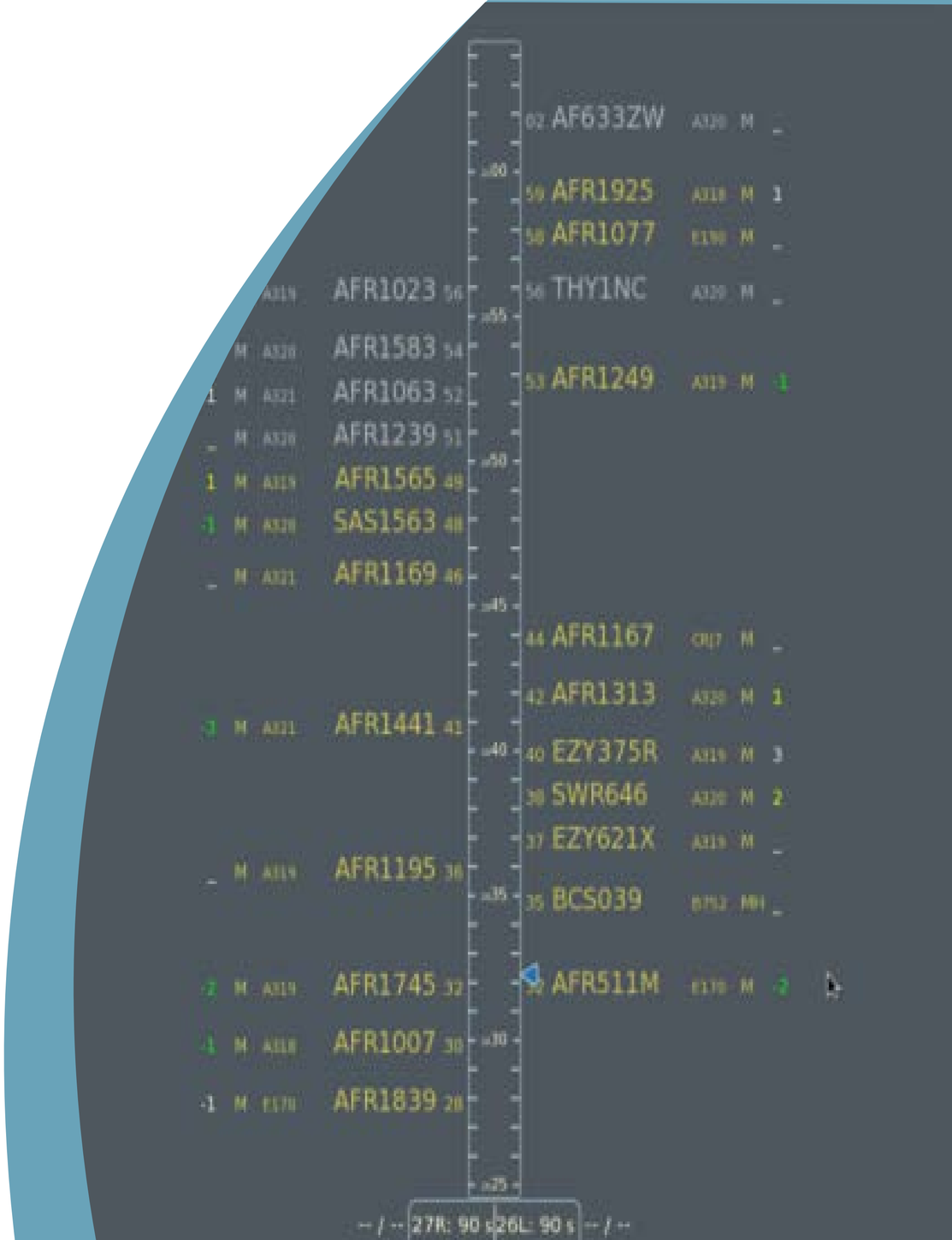
# MAESTRO

## AMAN



# MAESTRO AMAN Objectives

## Protect the TMA

- Control TMA inbound flow based on capacity
- Metering upstream by ACC via speed reductions (linear holding)
- Prevent congestions (holding patterns)

## Optimise Capacity

- +10% runway capacity in Copenhagen
- -30% decrease of Paris area capacity if MAESTRO is stopped

## Support Green Operations

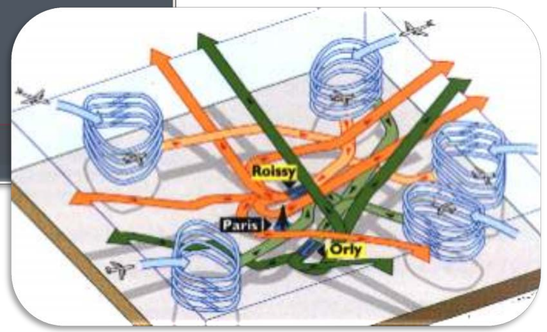
- Minimise taxi time
- Improve success rate of Performance-Based operations (RNP, CDO)

## Improve Controllers Collaboration

- Use ATC FDP for consistent arrival trajectory
- Integrated and consistent information presented to controllers in Tower, APP, ACC

## Manage Metroplex, Dense TMAs

- Multi airports with inter-dependent runway configuration management
- Traffic de-grouping at convergence hotspots in the TMA (metering fixes)

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# Controller Interfaces

## Timeline display

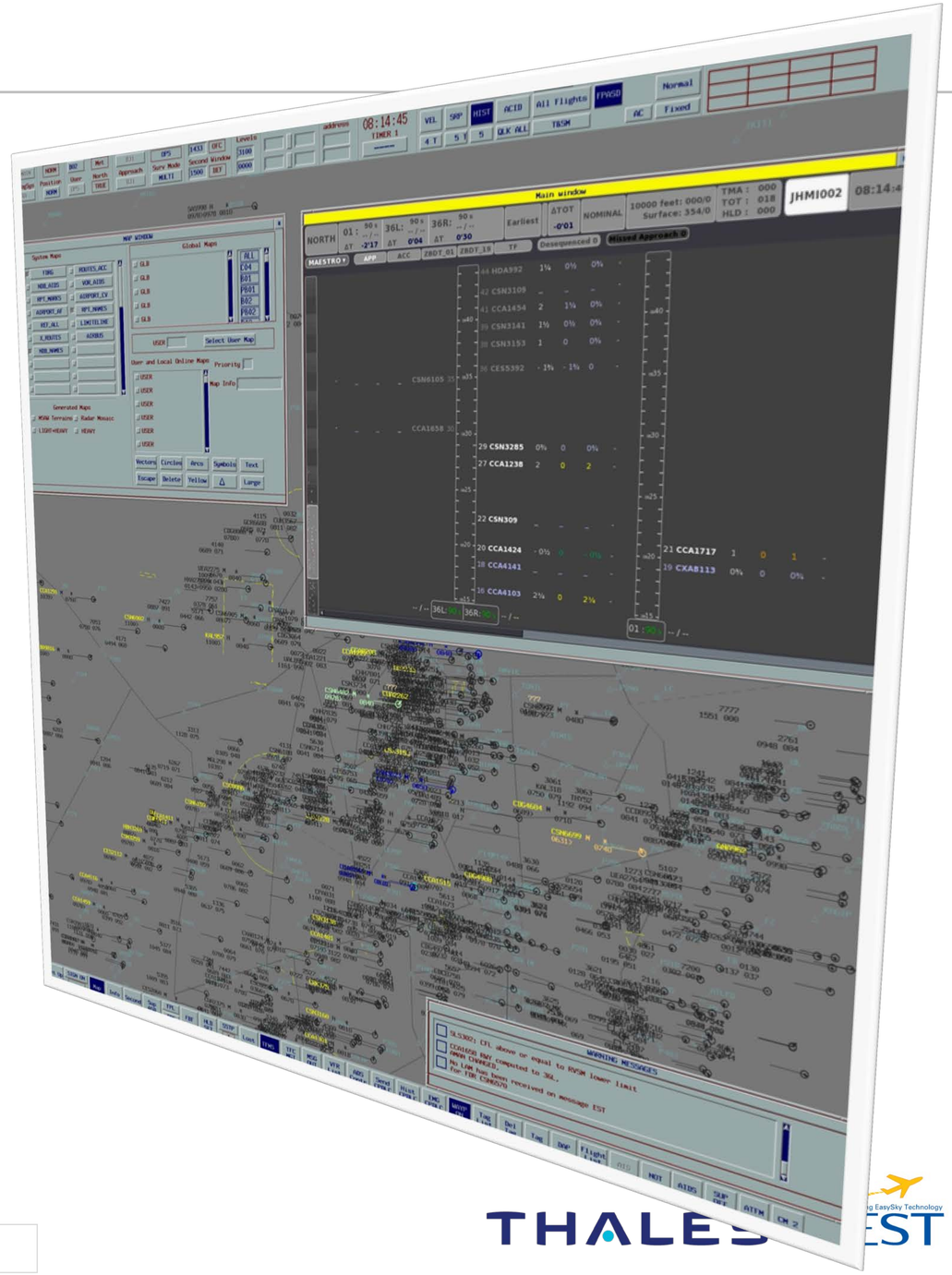
- For TMA and Flow controllers
- Integrated in the controller HMI
- Full visibility and control over the sequence
- Full control over airports runway configurations

## TTL/TTG display

- For TMA and ACC controllers
- Integrated to the track label
- Display a TTL/TTG value relevant for the controller (ACC delay vs TMA delay)

## Operational Supervision

- Full control over airports runway configurations
- Schedule and set runway capacities

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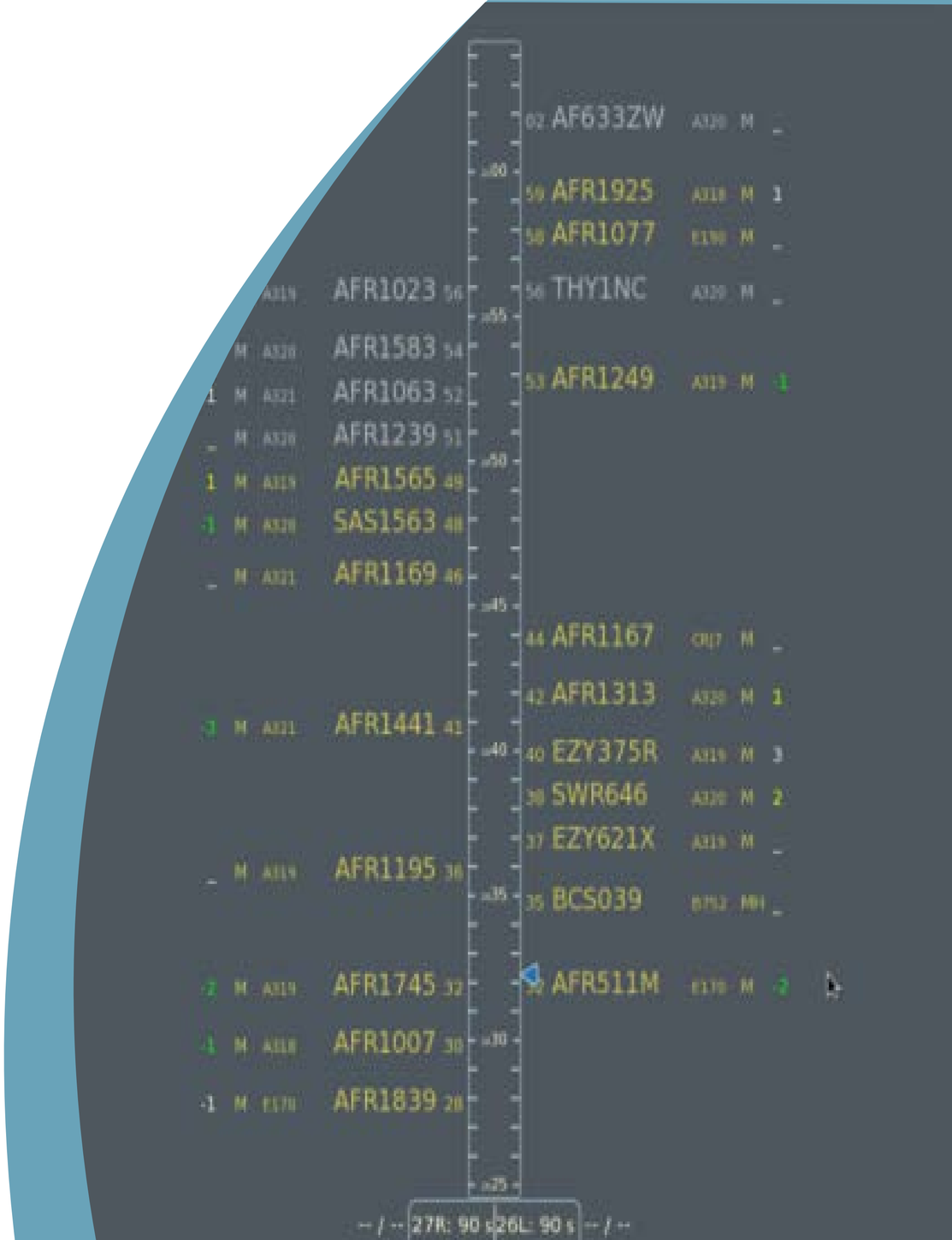
# MAESTRO

## DMAN

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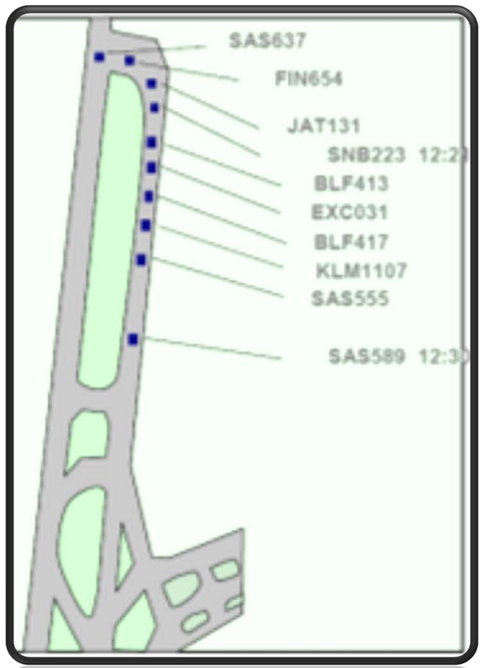
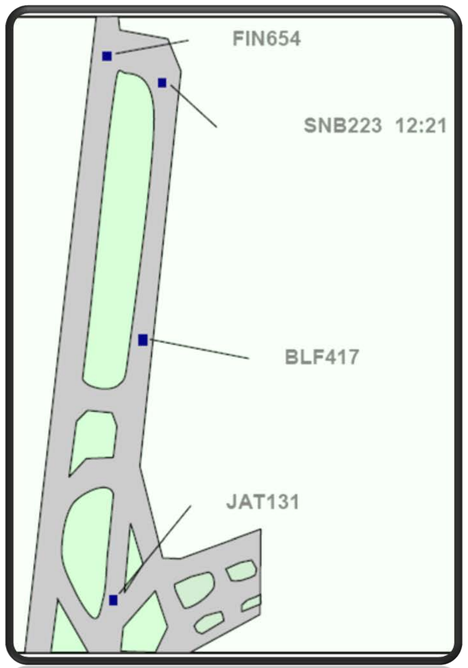
# MAESTRO DMAN Objectives

## Optimize Runway Pressure

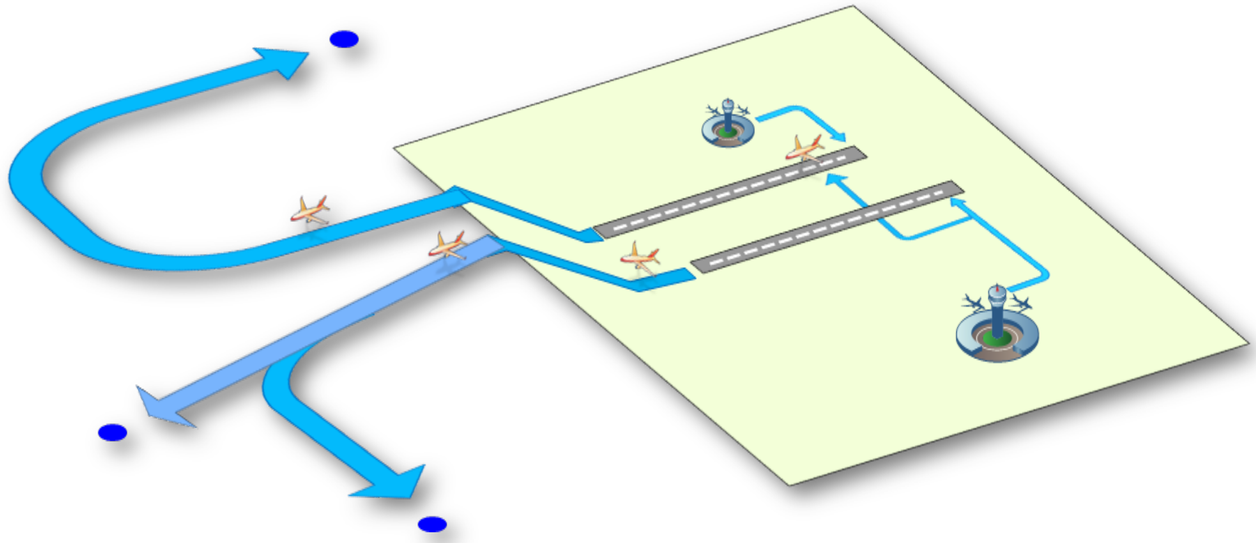
Without DMAN




With DMAN




## Best Allocated Runway



Tower controller focus on delivering clearances & safe movements
System optimises use of resources and punctuality

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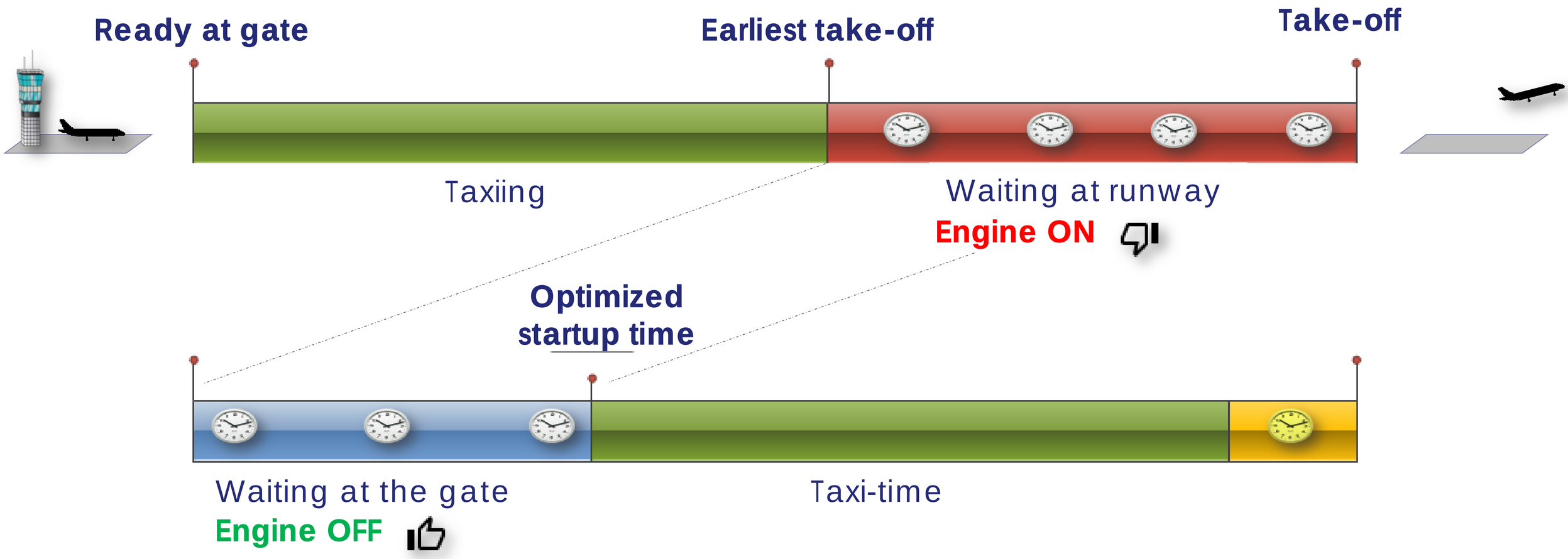
# DMAN Optimization

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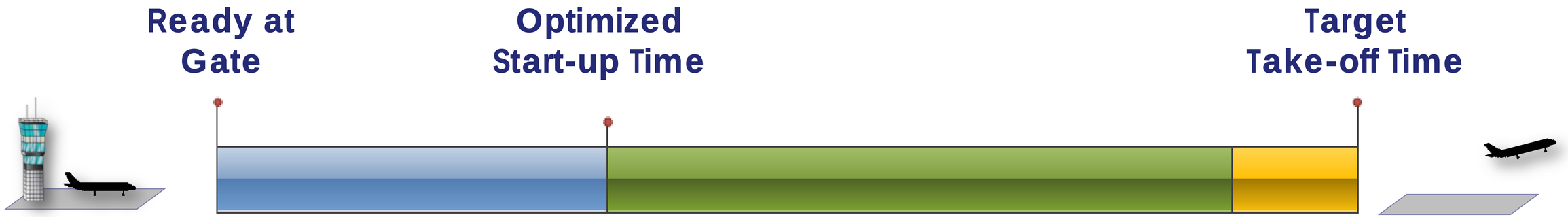
# DMAN & Collaboration




| | Planning | Boarding | Taxiing | Runway Capacity | Flow Constraints | |
|---|---|---|---|---|---|---|
| **Variables** | EOBT<br>Aircraft type<br>Gate<br>VIP<br>… | TOBT => Ready | Taxi time | Separation with landing flights (mixed mode) | CTOT<br>Ground delay (congestion at nearby ADES) | Metering @ SID Exit |
| **Sources in China** | **ATC Tower EFS** | **Regional CDM** | **A-SMGCS** | **AMAN** | **Regional CDM AMAN** | |

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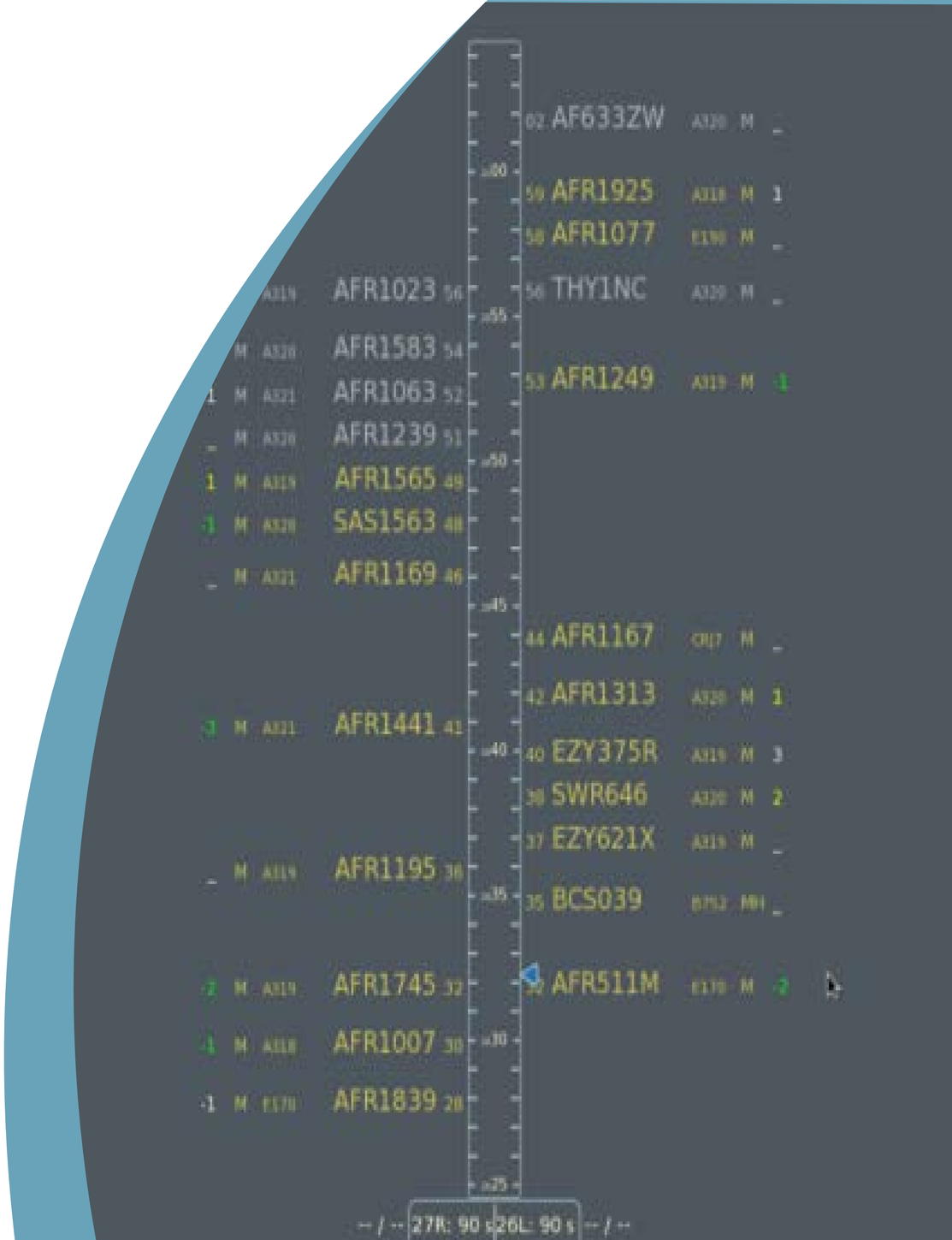
# MAESTRO in China

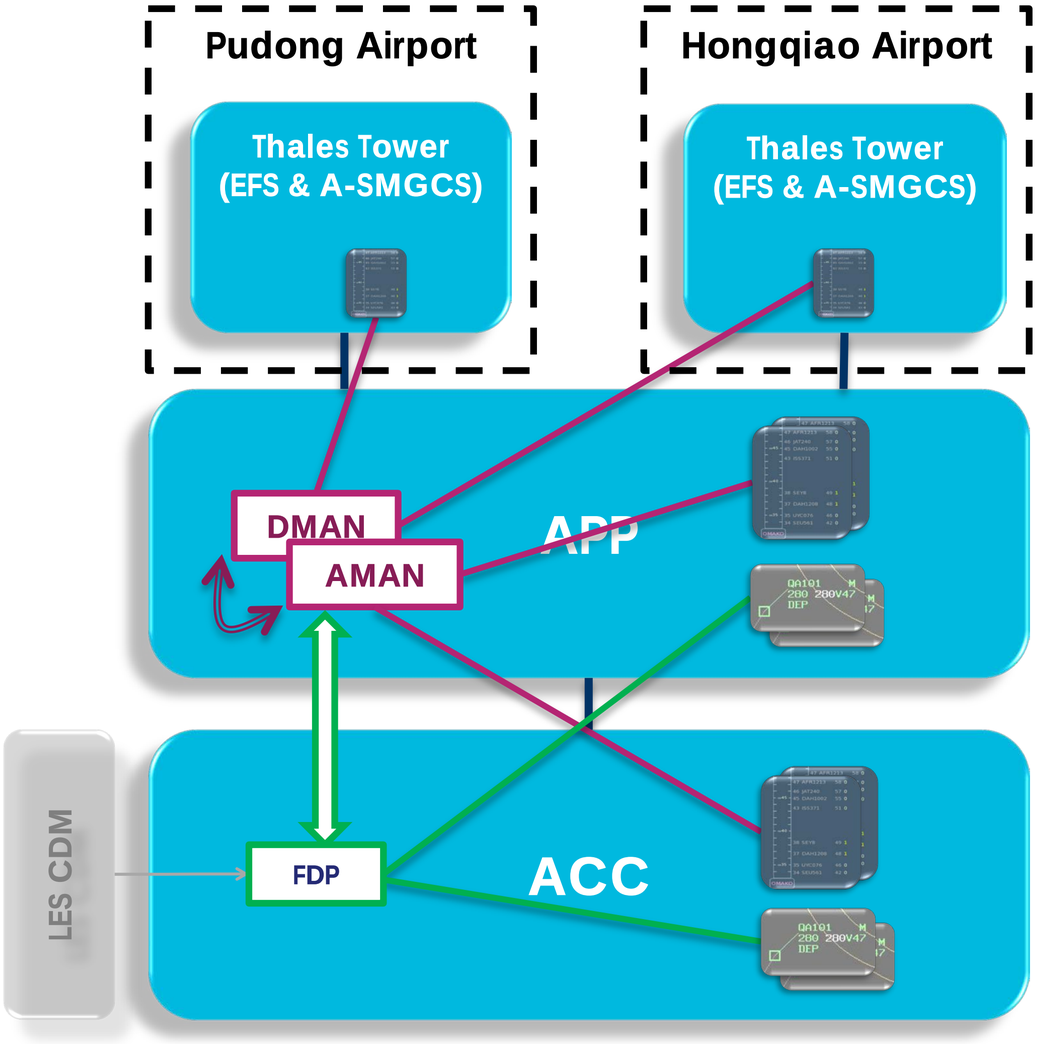
## Deployment, Architecture & Status



# MAESTRO in Shanghai

## Shanghai

- Centralised FDP
- Integrated AMAN/DMAN
- Managed airports for AMAN & DMAN
  - Hongqiao
  - Pudong
- THALES tower system (EFS and A-SMGCS)
- External CDM system (CTOT)

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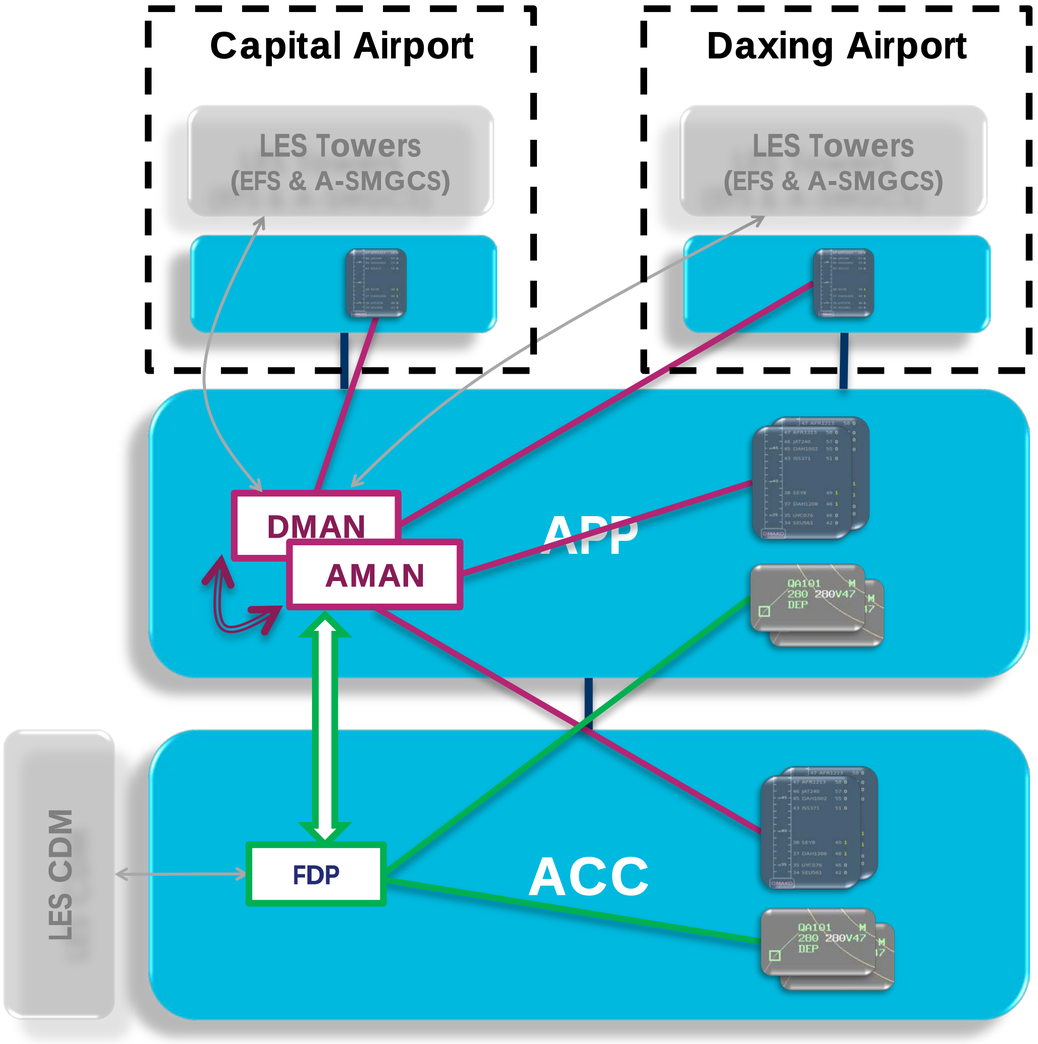
# MAESTRO in Beijing

## Beijing

- Centralised FDP
- Integrated AMAN/DMAN
- Managed airports for AMAN & DMAN
  - Capital
  - Daxing (new)
- LES tower system (EFS and A-SMGCS)
- LES CDM system (CTOT, TOBT)

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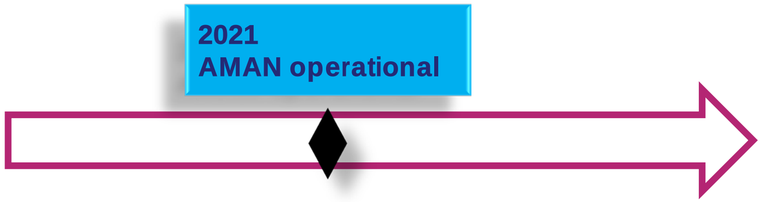
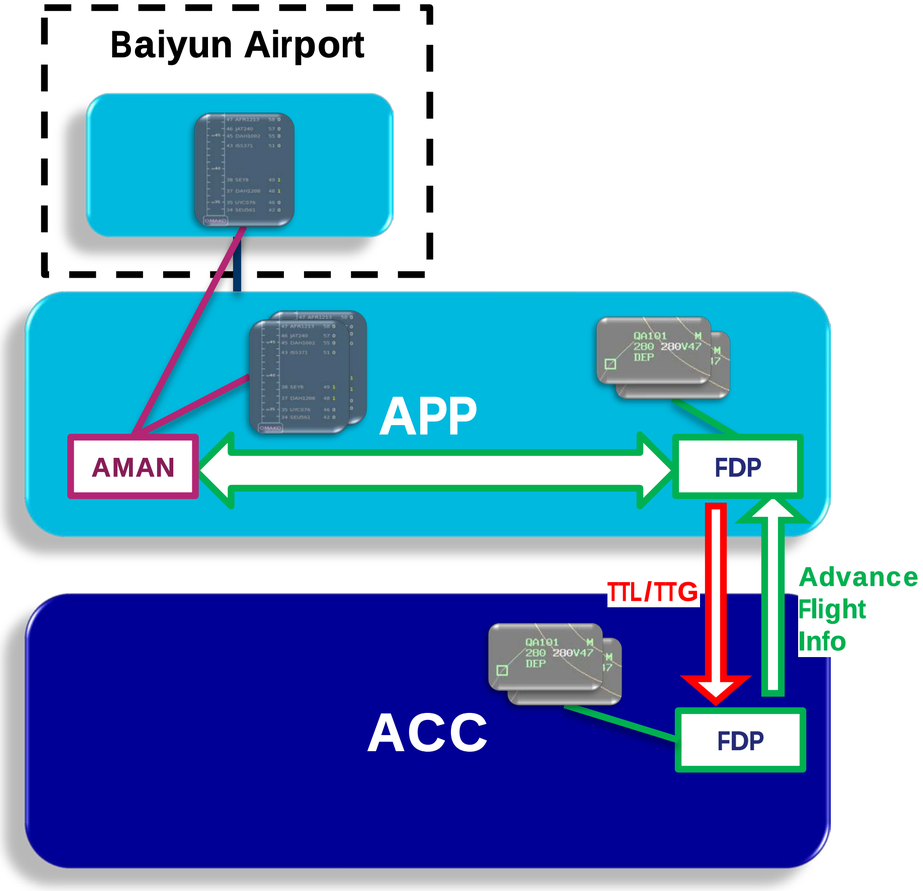
# MAESTRO in Guangzhou




## Guangzou

- Distributed FDP
- AMAN
- Managed airport: Baiyun

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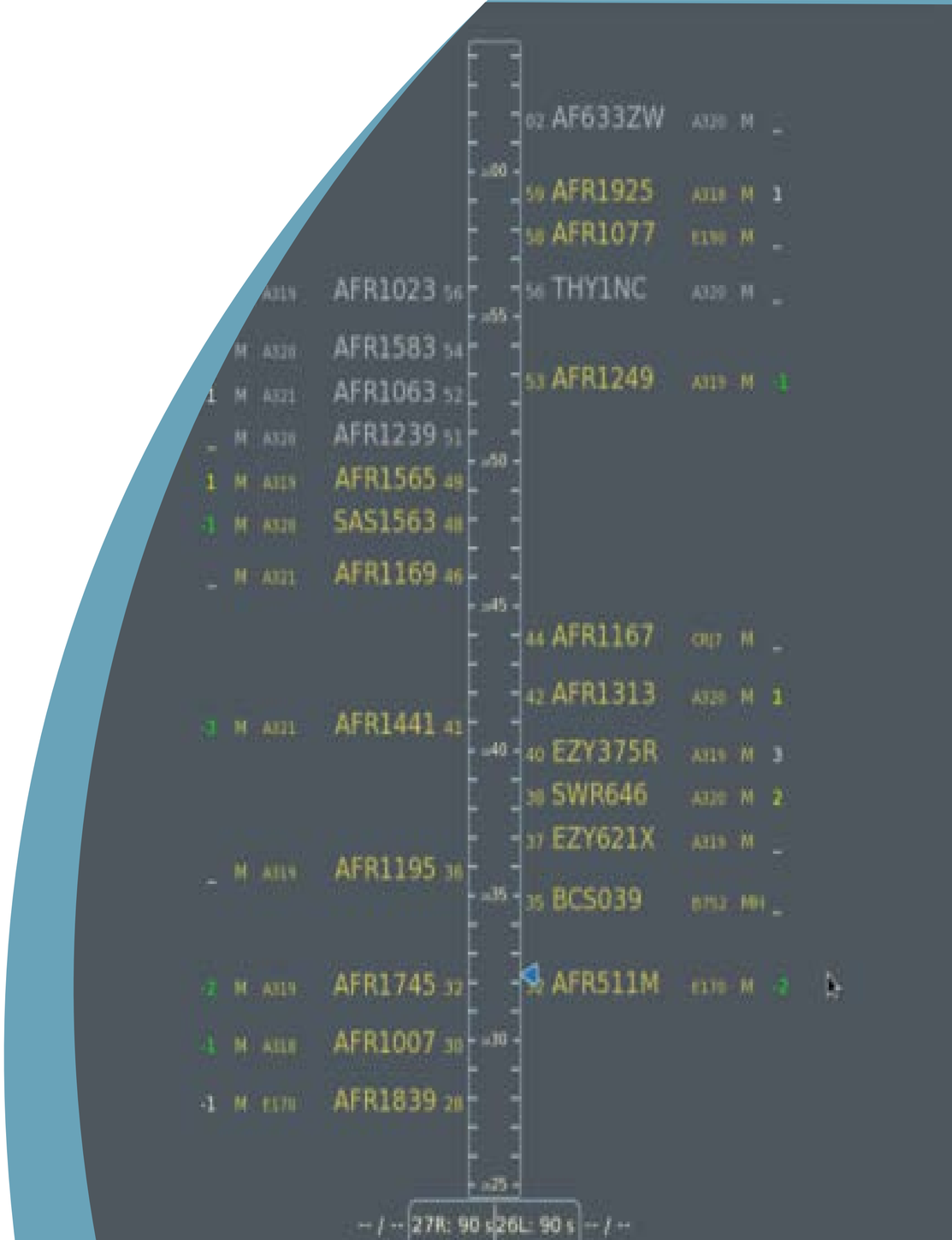
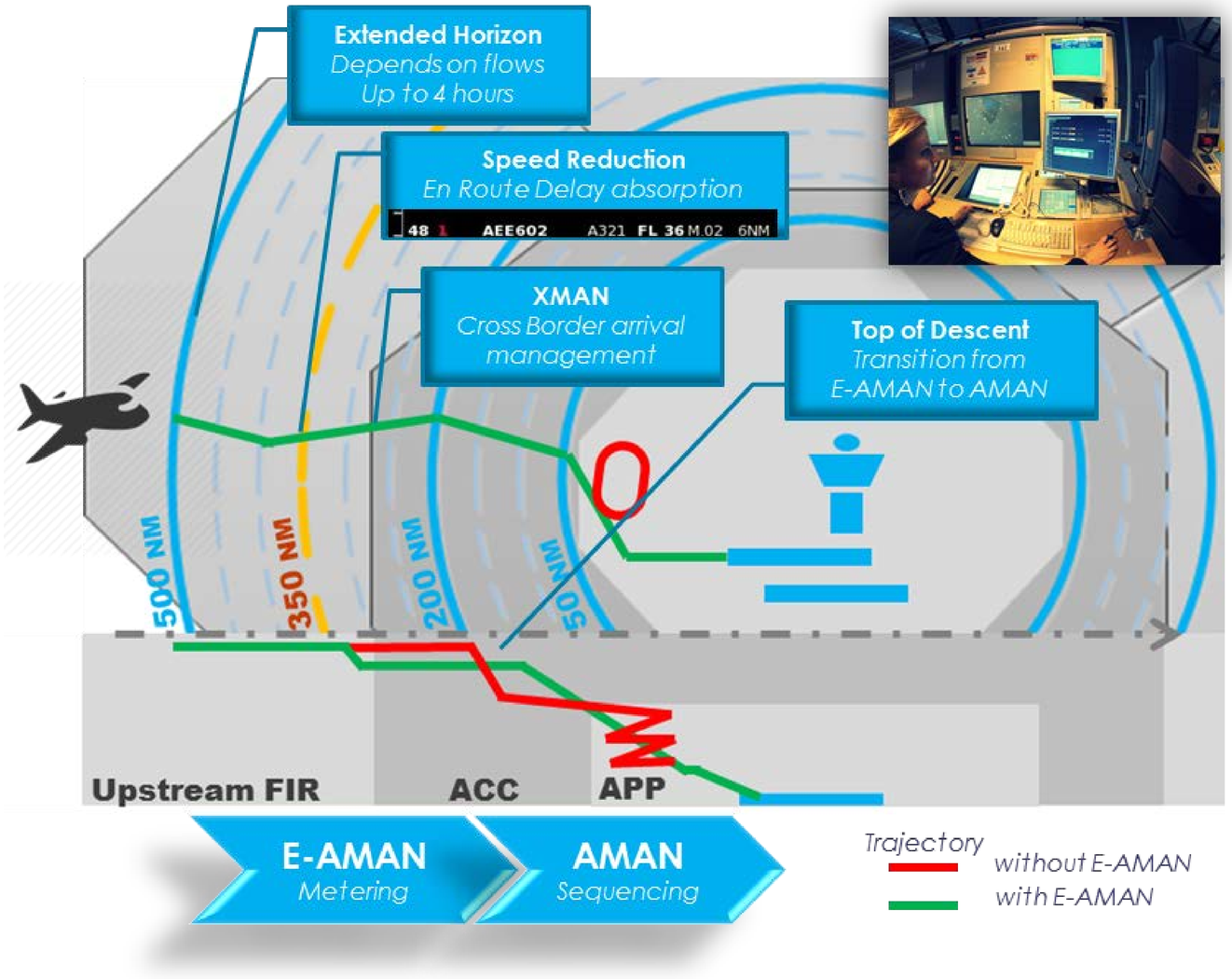
# Extended AMAN (E-AMAN)

## R&D, SESAR



# E-AMAN




## Key concept elements

- **Delegate part of the delay to the Upstream ATSU**
- **Metering at ATSUs boundary**

## Enabler

- **SWIM in order for ATSUs to collaborate**
  - Up-to-date trajectories
  - Share arrival sequence, delay information and advices

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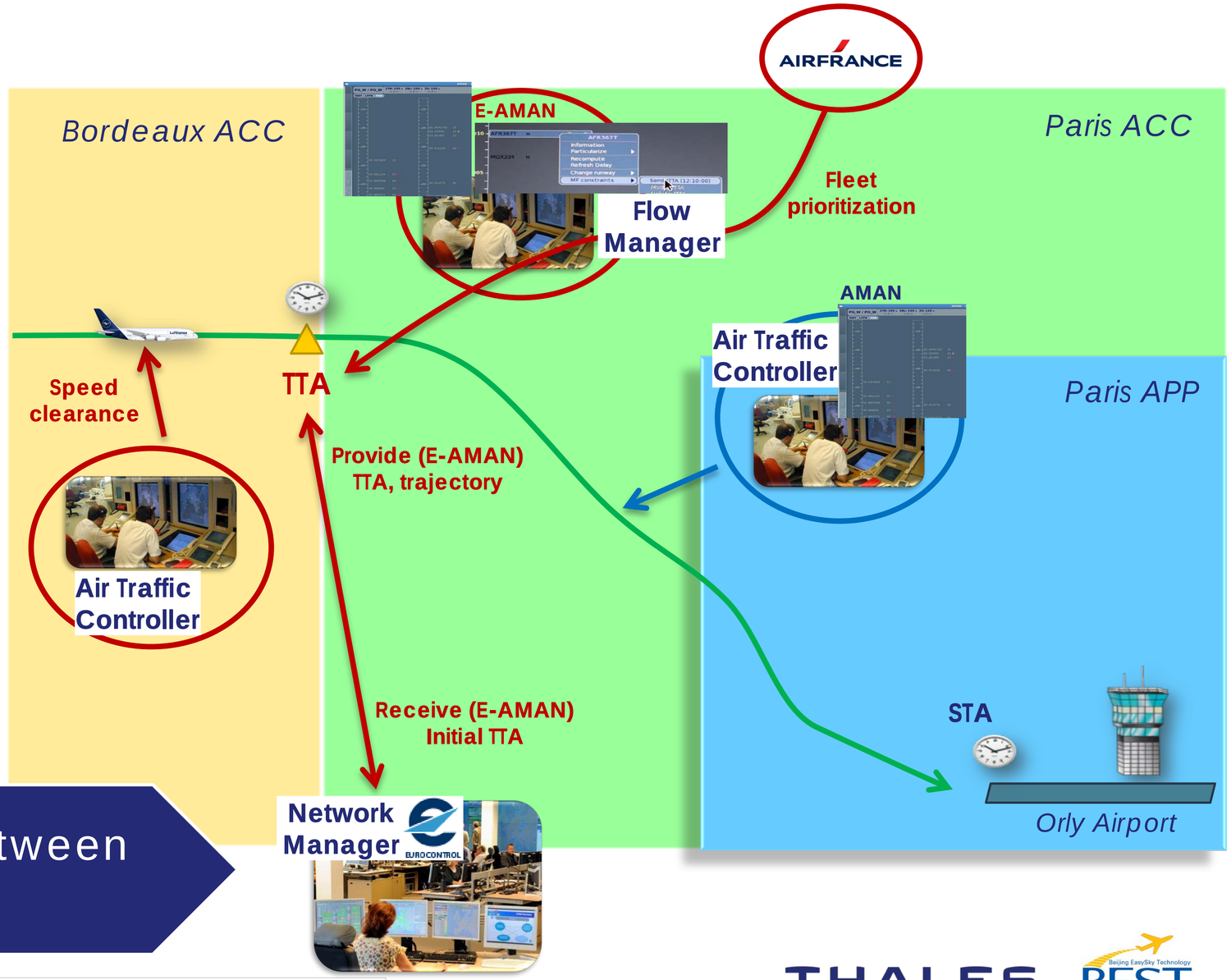
# E-AMAN Trial (xStream)

## Lead by DSNA, 2017-2019

- Improve arrival efficiency at Orly airport, Paris
- E-AMAN trial to test the collaboration between ATFM, Airlines, ACC control and TMA control

## Features

- Target Time of Arrival @ coordination point
- MAESTRO E-AMAN in Paris ACC
  - Use TTA issued by the ATFM
  - Supports TTA swapping to enable fleet prioritization by airlines
- MAESTRO AMAN in Paris APP




Requires close synchronisation between ATFM, E-AMAN and AMAN

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# Thank You