南京莱斯信息技术股份有限公司
Nanjing LES Information Technology Co., Ltd

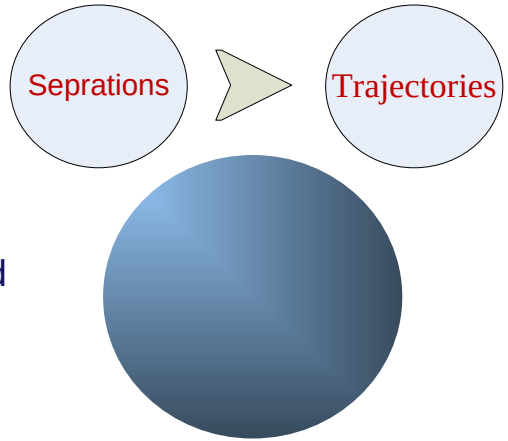
Imminent changes of ATM Automation System based on 4D&TBO

ICAO, China, November 2018

Trajectory based Operation (TBO)

TBO is the tendency and crucial part of the air transport development, combining advanced Flight Management Systems (FMS) with ground automation systems to manage aircraft position and timing.

- Air-to-Ground information sharing
- Promote collaboration among aviation business units and seamless track management
- Optimal trajectory planning
- Improve the operation quality of ATC system and solve arrival management and air traffic flow management problems



Trajectory based Operation (TBO)

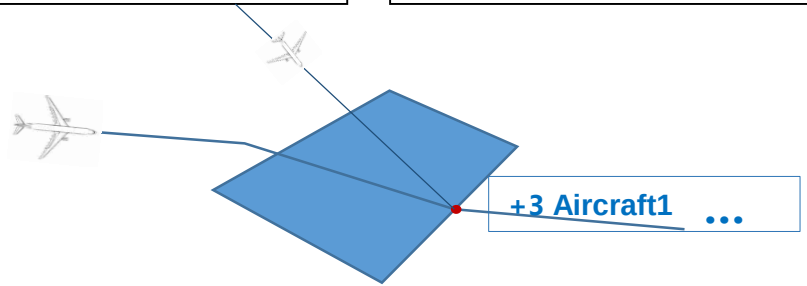
TBO cannot make a qualitative change to the air transport. However, it can gradually promote all aspects of air transport development.

Controllability

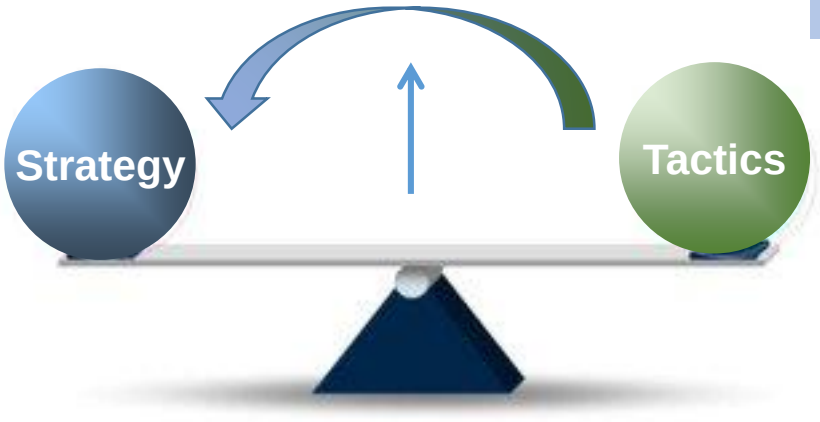
- Accurate position
- Timing control
- Separation control

Availability

- Improve airspace capacity
- Optimize separation
- Reduce ATC workload



Core of TBO - 4-Dimensional Trajectory (4DT) Prediction



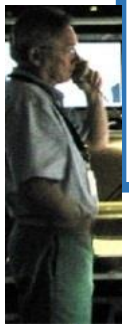
4DT of ATC system + 4D of Airborne System

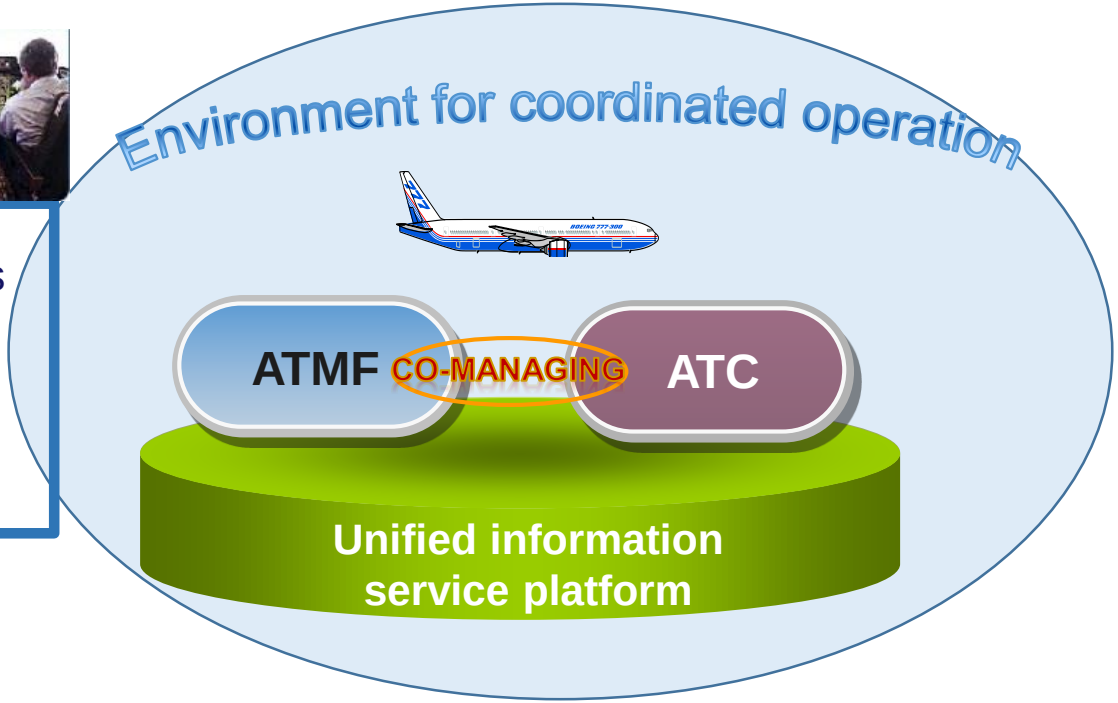
Significantly make the conflict predictions in advance

Recommendations to optimize tracking

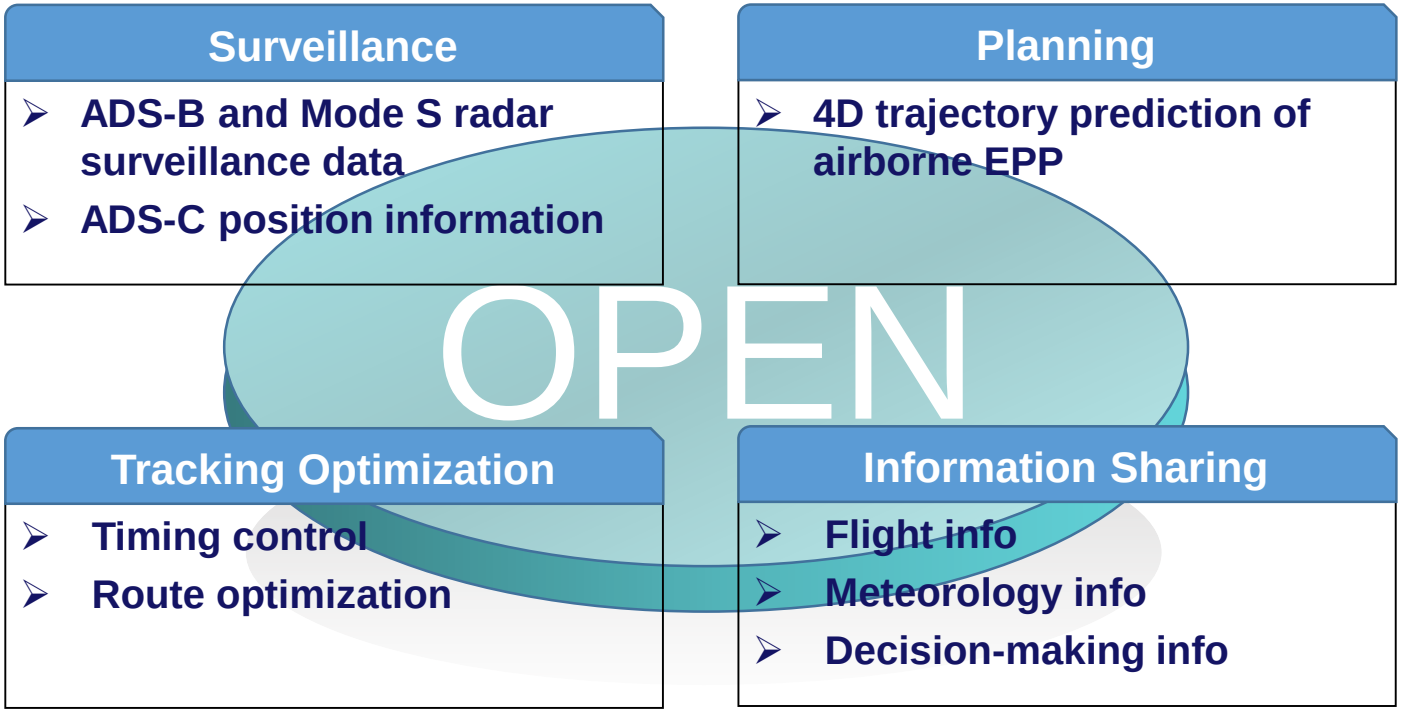
Role of ATM Automation System in TBO

- Common situation awareness
- Digital control
- CDM implementation





Facing changes for ATM Automation System



ATM Automation System will be facing …

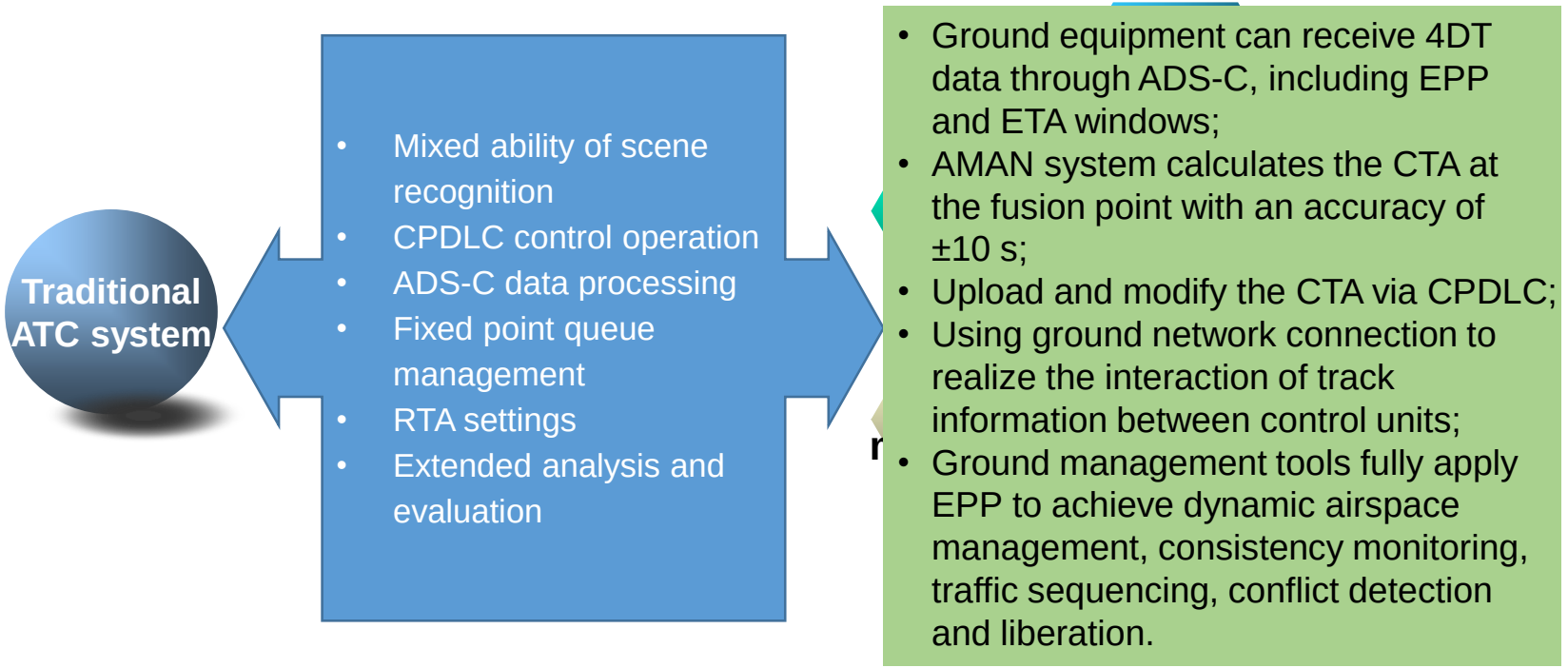
TBO operation environment

- Non-TBO capable aircraft
- Less-TBO capable aircraft
- Most-TBO capable aircraft
- All-TBO capable aircraft

challenges

- Voice or digital control ?
- Choose which aircraft to control?
- Dynamic route planning?

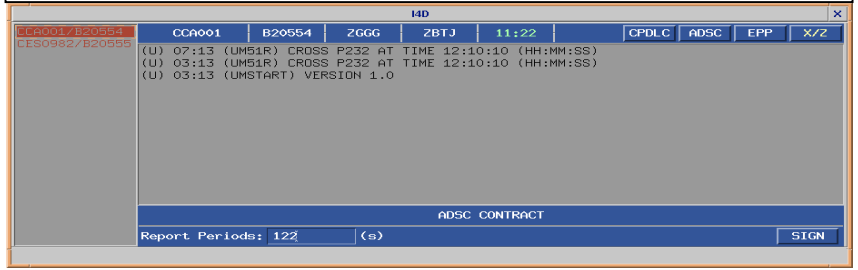
Progress of ATM Automation System changes



The Changes of ATM Automation System

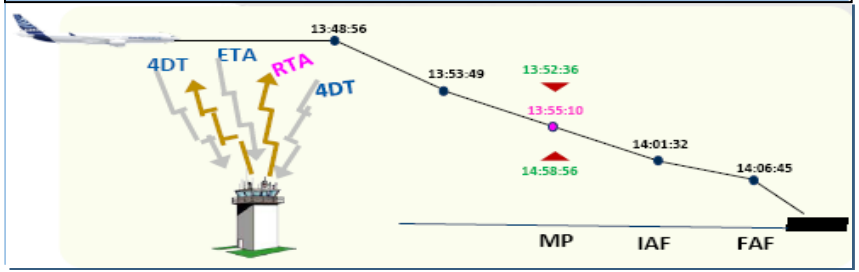
Basis

- Capable of G-A communication
- Capable of digitalized control
- Equipped with flight flow decision-making tools
- SWIM



Capabilities

- Combine advanced Flight Management System (FMS) with automation system to manage the position, altitude and timing of aircraft tracks so as to improve the stability, predictability and efficiency of the ATM system.
- The RTA function of FMS is employed to achieve STA so as to reduce controller intervention.



Functional Improvement for ATM Automation System

Based on the ATC automation system, new functional modules are superimposed to support TBO operation.

Open interfaces

- Data link interfaces
- 4029.3
- Active MQ
- Customized IP interfaces

System capabilities

- Surveillance
- Alert
- Interval management
- HMI

Auxiliary control

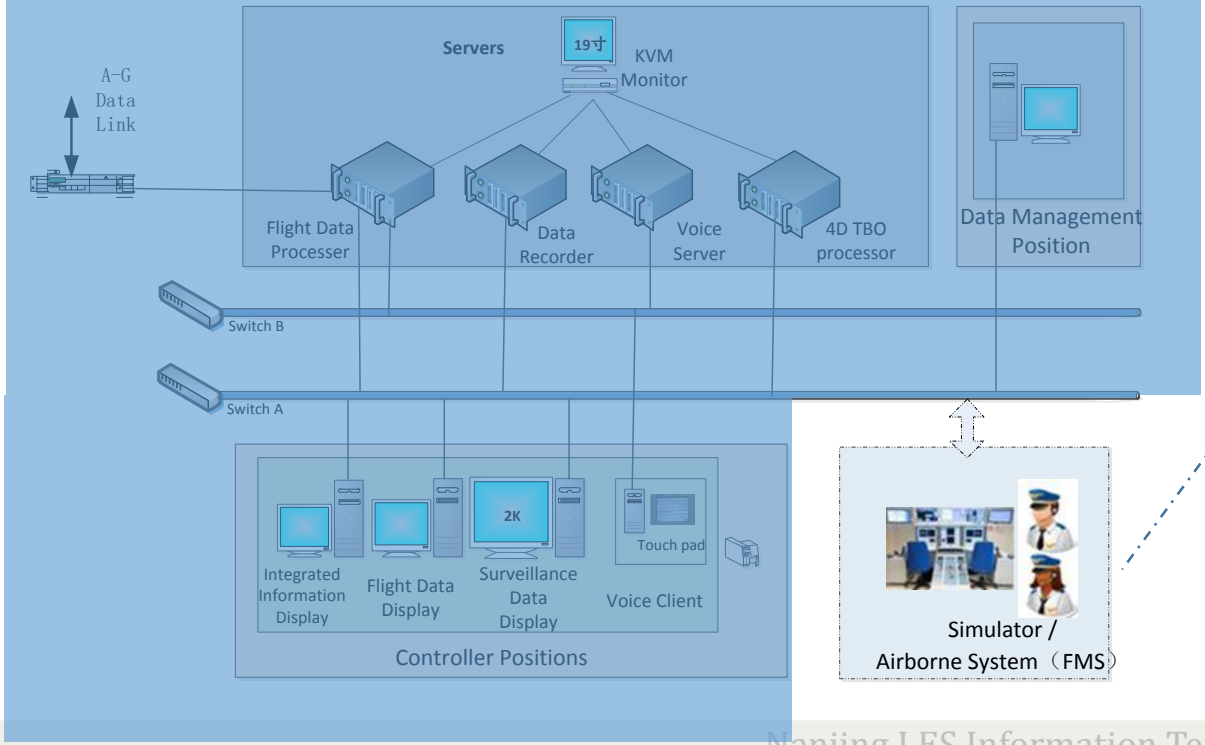
- 4D trajectory optimization
- Flight route optimization
- Digitalized control
- Control command execution monitoring

Increased function modules

- Data link processing
- RTA
- AMAN
- ……

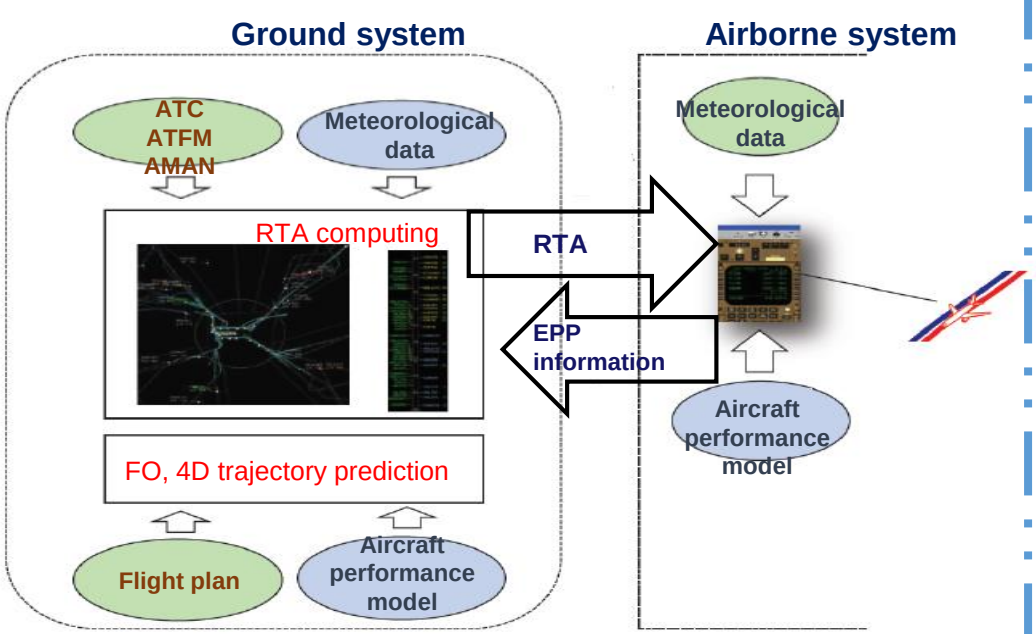
Prototype System

A TBO-capable automation system

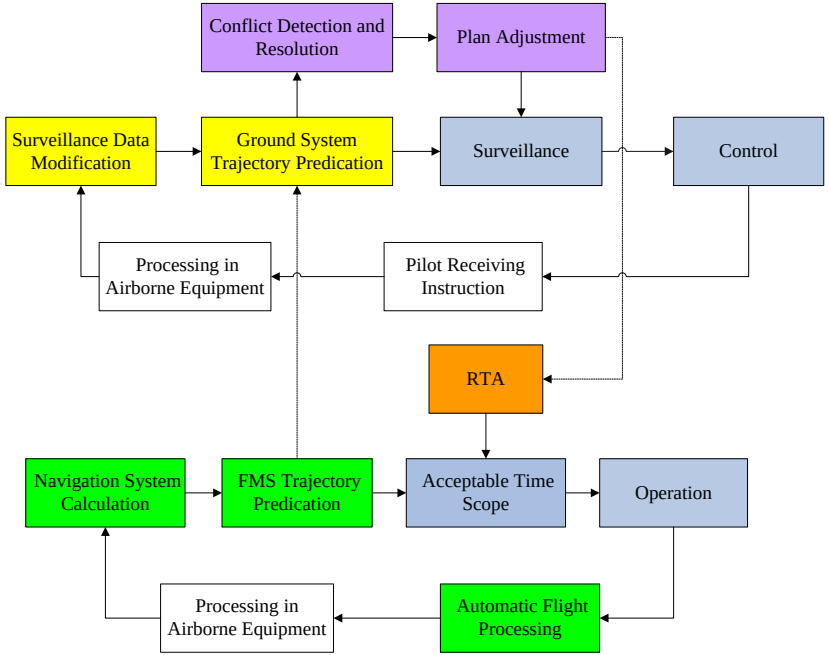


Information sharing via IP network and third-party simulator / airborne FMS system

RTA Processing Mechanism of ATM Automation System



RTA coordination flow



Milestones

Year 2016

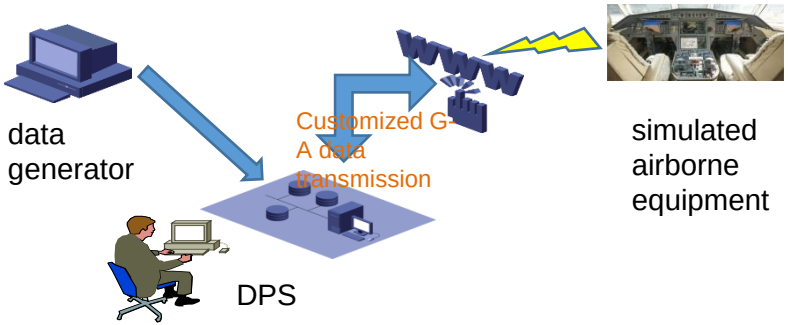
- G-A communication equipment
- Research of ATM automation prototype system

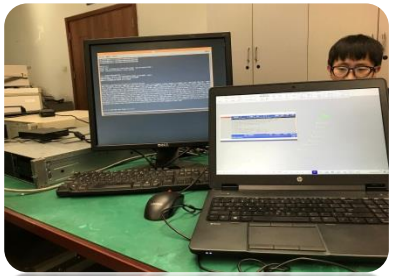
Year 2017

- CPDLC/ADS-C integration test
- Airbus simulation SVS/ADS-C test

Year 2018

- Real flight verification
- Test and evaluation





Phases

EPP updating periodically, shares the aircraft current position

Establish link

Contract

Speed regulation

Set up RTA

Diversion

Disconnect link

Establish link

Internal assignment

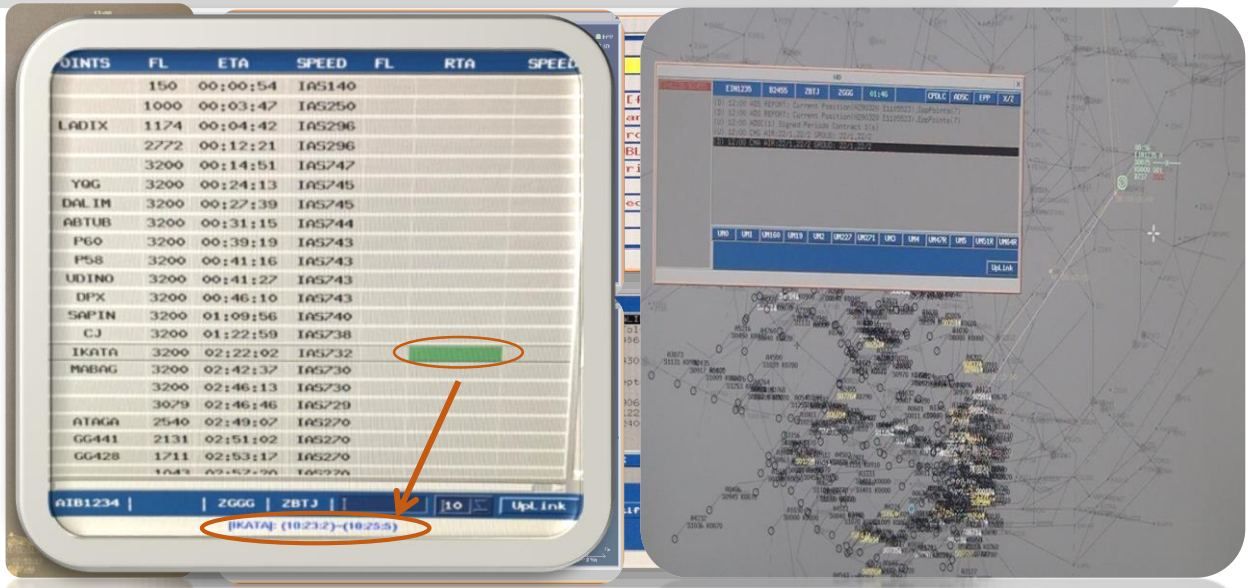
Handover

RTA setup

Disconnect link

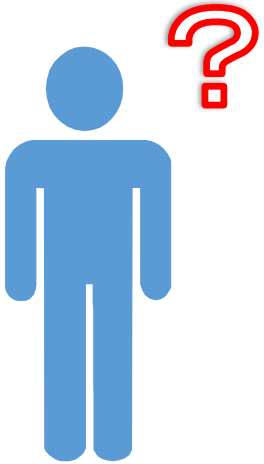
Increased Functionalities of ATM Automation System

- G-A coordination
- 4D prediction trajectory and EPP
- RTA
- ……



- Using EPP information improves the position accuracy and predicted position accuracy of the track for ground system;
- Enhance the precise execution of regulatory commands;
- High-precision position sensing improves conflict detection and safety management and reduces controller workload;
- Improve the accuracy of ETA in AMAN functions and promote the pre-planning and deployment of airport resources;

Future trends of TBO-based ATM Automation System



- Transition from voice control to digitalized control
- Performance monitoring
- Conflict detection and avoidance in advance
- Maximum utilization of flow management and airspace

Thank you for your attention!

CETC 中国电科

责任 创新 卓越 共享 Responsibility Innovation Excellence Shared