



Asia Pacific Region Innovation &
Capacity Building Symposium 2023

A/G Connectivity Solutions for TBO

Aviation Data Communication Corporation (ADCC)

Zhu Yanbo

Dec 2023




Aviation Data Communication Corporation (ADCC)

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- Established : June 1996
- Mission : Management and operation of datalink in China airspace
- Shareholders : Air Traffic Management Bureau (ATMB), Air China, China Eastern Airlines, China Southern Airlines and Xiamen Airlines

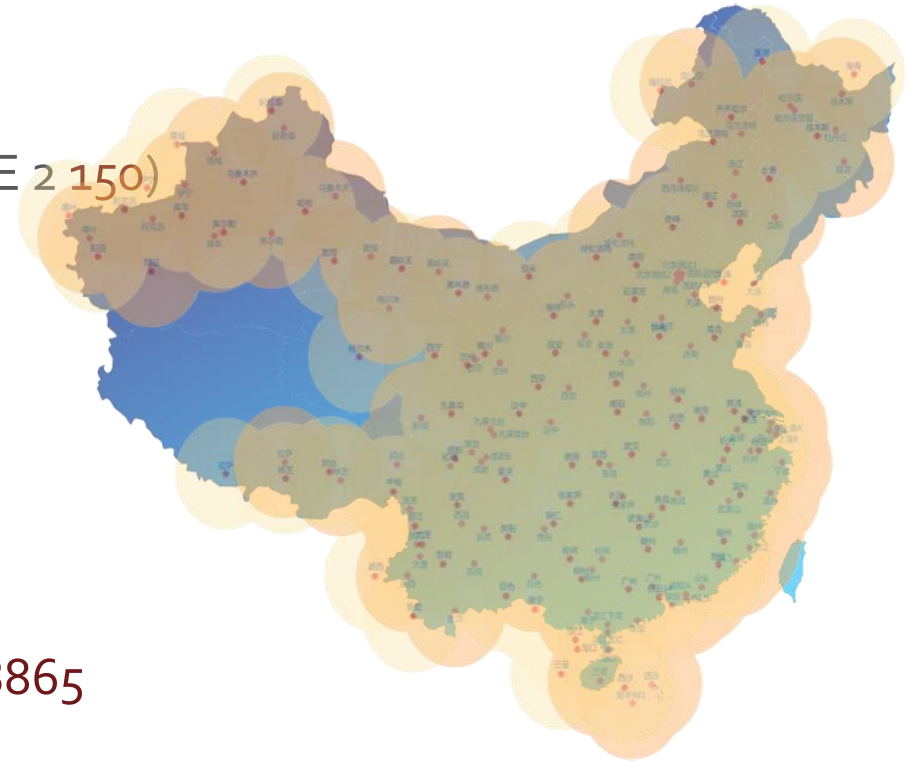


- Board Chairman : MR. LI Qiguo , Chairman of labor union of ATMB, CAAC
- Affiliates:  JVC ADARI (2006), State key Laboratory of CNS/ATM, Chengdu and Xi'an subsidiaries

A/G Datalink Network

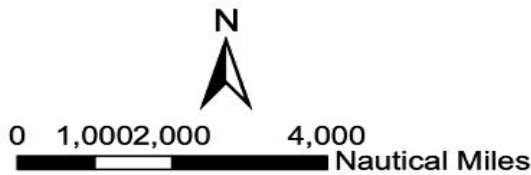
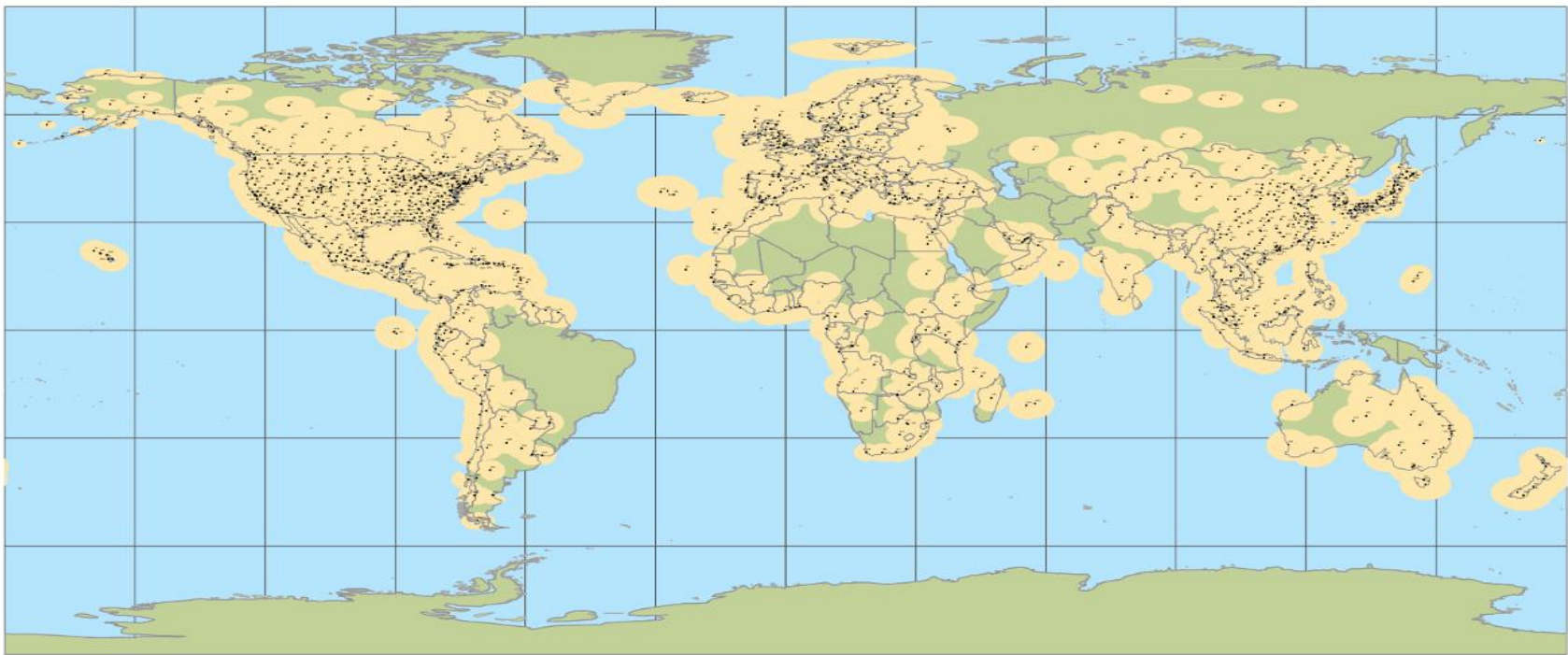
GLOBALinkSM/VHF ACARS/VDL M2

- Airports: 163
- Stations: 231
- Channels: 500 (include VDL MODE 2 150)
- Airline Customers: 169
 - China domestic airlines: 58
 - Foreign airlines: 111
- ATC Users: 52
- Number of Registered Aircrafts: 8865
- Monthly Avg. Traffic: 66.6 Gbits
- ADCC, ARINC (Collins Aerospace) and AEROTHAI jointly established GLOBALinkSM datalink service in 1998



A/G Datalink Network

GLOBALink/VHF - World



Notes:
The map projection is Geographic and is for representation only. Not to scale.
Terrain obstructions are not considered.

Legend:

• Operational

GLOBALink VHF - World
Operational Coverage

Drawn By:
cborman

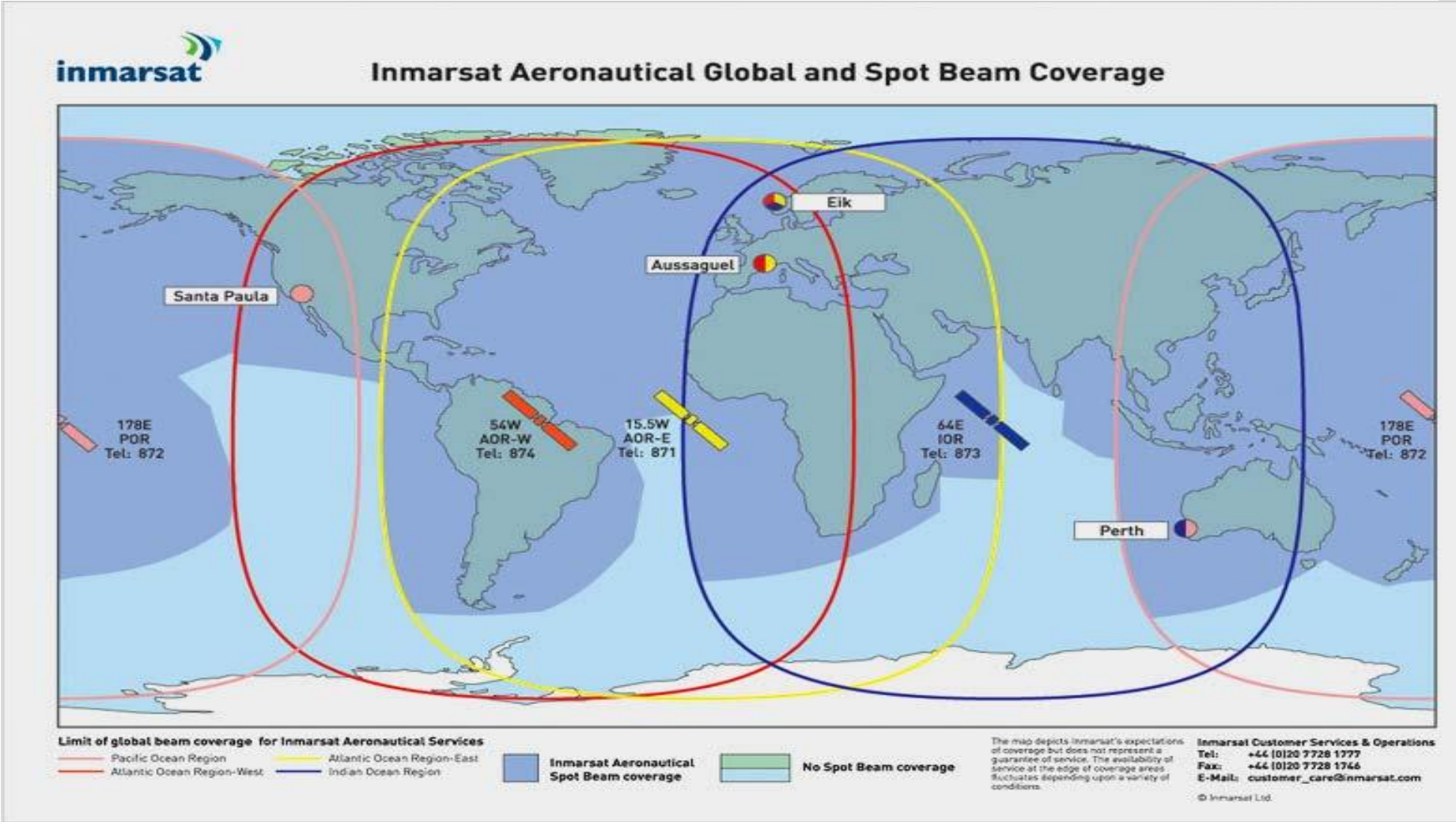
Filename:
GL VHF WORLD op.mxd

Effective Date:
Jan 08, 2020



A/G Datalink Network

GLOBALink/Inmarsat



Aviation Product & Service

Aviation Product & Service

- A/G Datalink Network
 - VHF Datalink Network
 - SATCOM
- Aviation Product & Service
 - Air Traffic Control(ATC)
 - Air Traffic Flow Management(ATFM)
 - Air Traffic Service(ATS)
 - Airline Operation Control (AOC)

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A/G Datalink Service in China

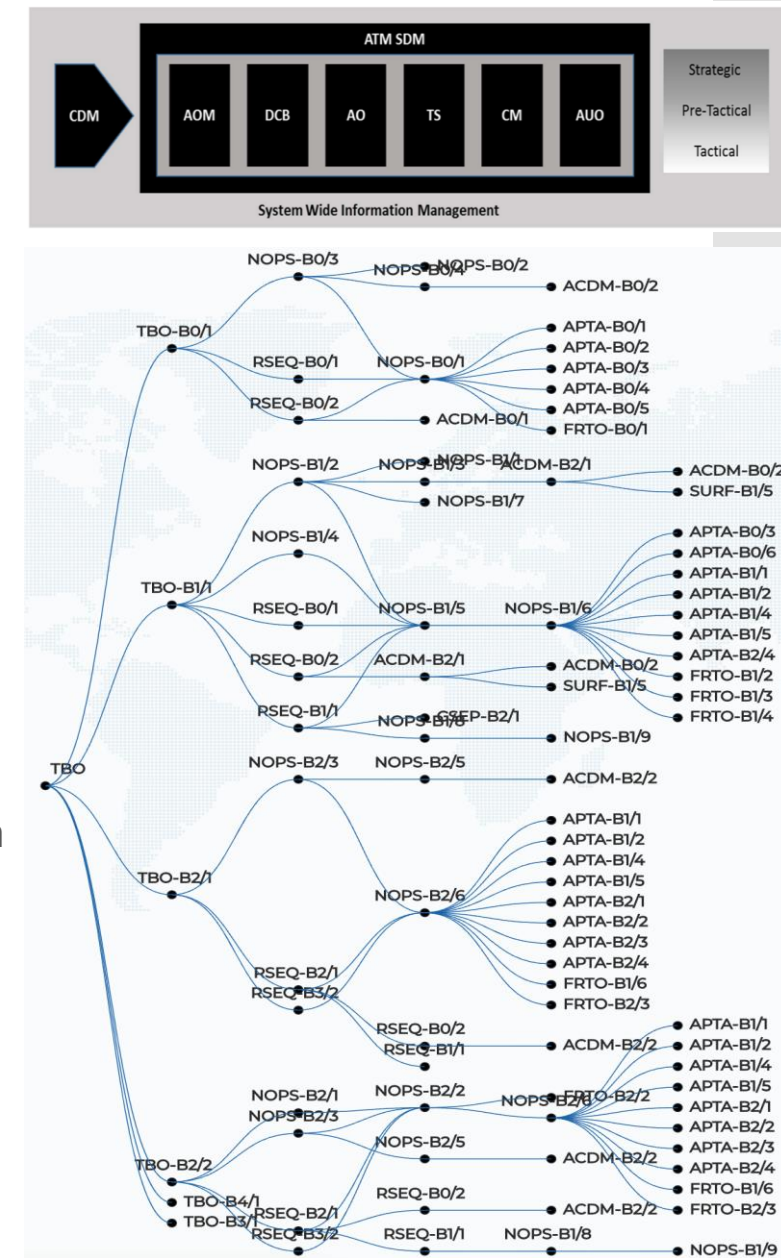
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A/G Connectivity Solutions for TBO

TBO Definition:

TBO Definition:

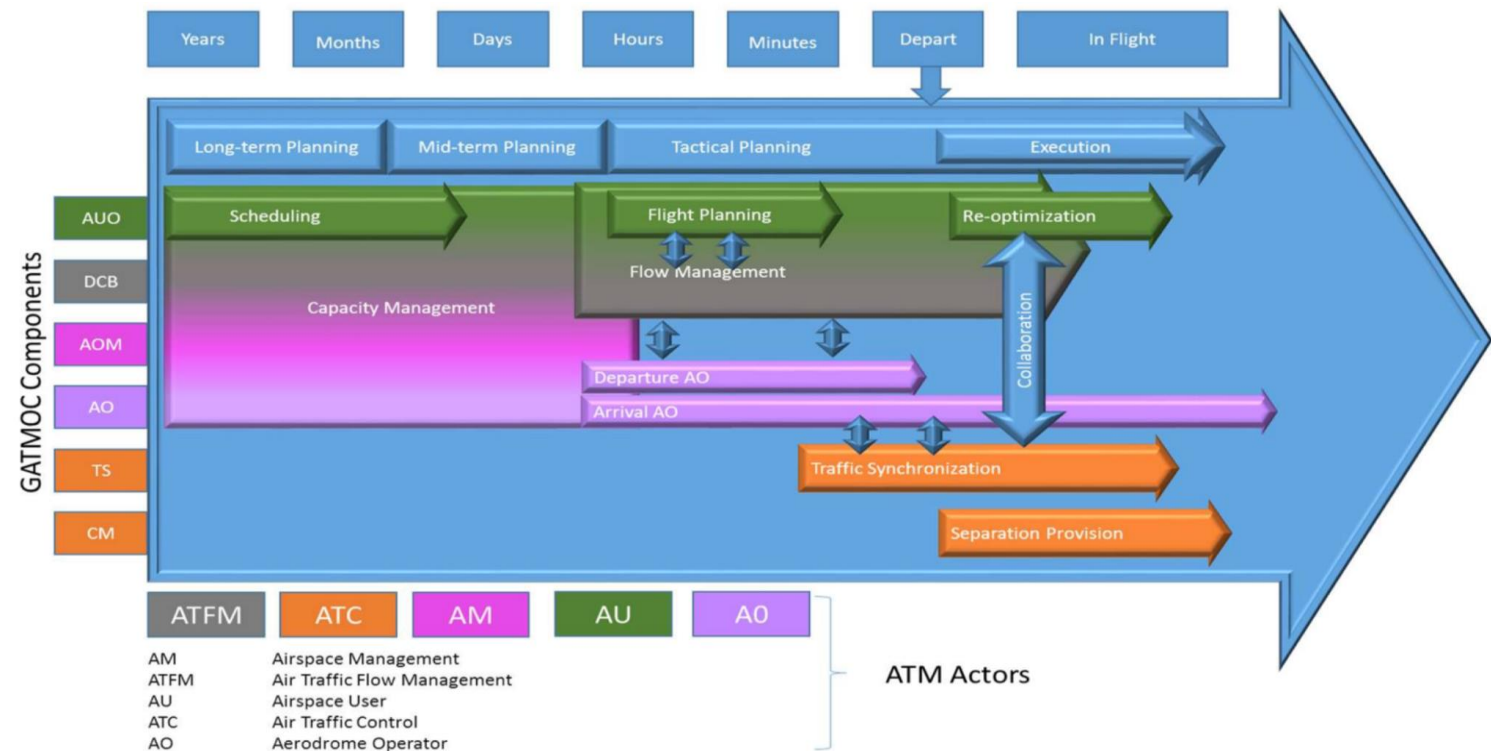
- TBO enables globally consistent performance-based 4D trajectory management by **sharing and managing** trajectory information.
- TBO will enhance **planning and execution of efficient flights**, reducing potential conflicts and resolving upcoming network and system demand/capacity imbalances.
- TBO covers **ATM processes** starting at the point an individual flight is being planned through flight execution to post flight activities.
- ICAO defines TBO in GANP as the **total integration and ultimate realization goal** for all types of ASBU leads, **planned to be achieved gradually by 2031.**



ICAO TBO Concept

Key Properties of TBO Evolution:

- Pre-Departure Trajectory Information Sharing & Negotiation
- Flight-execution Trajectory Information Sharing & Negotiation
- Aircraft downlink of Intent
- Air-Ground Synchronization



TBO Technical Environment

Ground Systems:

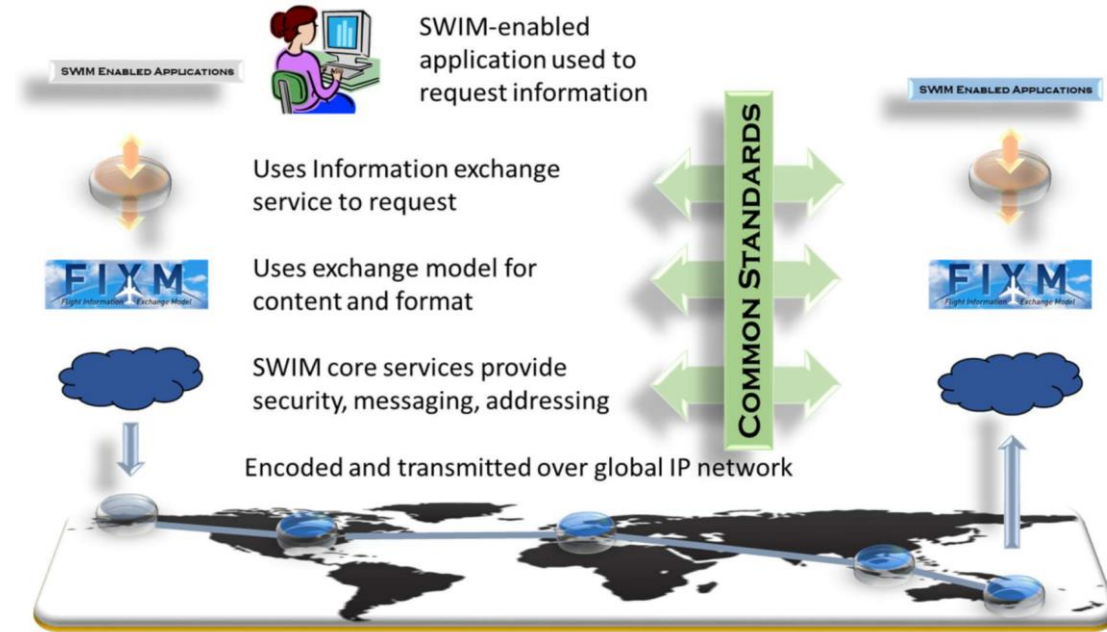
- SWIM
- FF-ICE
- AMET/DAIM
- ATC Automation

Airborne Systems:

- Flight Management System (FMS)
- Controller-Pilot Data Link Communications (CPDLC)
- Downlink of Aircraft-Derived Trajectory and Parameters (e.g. via ADS-C)
- Precise clearance delivery (e.g., PBN and RTA)
- A-G SWIM

Air/Ground Datalink:

- VDL, LDACS, Satcom, and etc.
- ATN



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A/G Connectivity Solutions for TBO

A-G Datalink

- Operating ACARS and AeroMACS networks, cooperates with INMARSAT, support multi-link fusion capability.

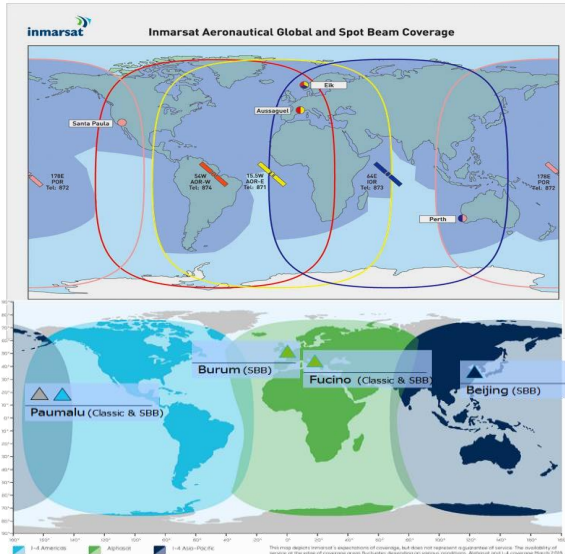
VHF ACARS

over 231 stations in 163 airports in China's airspace



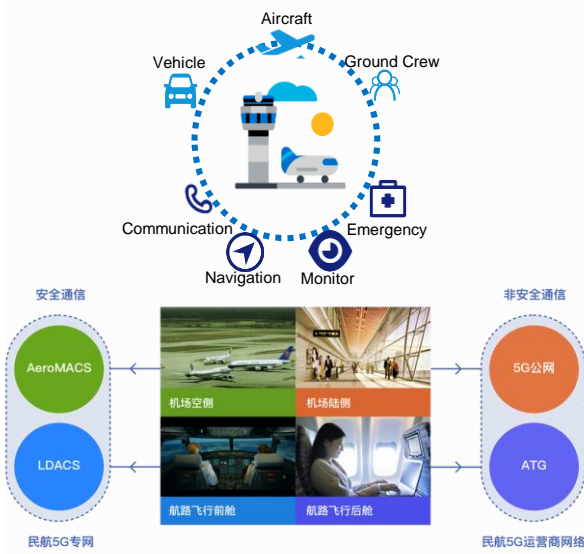
INMARSAT

Cooperate with CTTIC, provide Inmarsat ACARS & SB-S datalink in China



AeroMACS

Carry out 5G AeroMACS research & standardization, promoting AeroMACS networking in major airports in China



Datalink Application & Service for ATC

TOWER:

- By the end of 2023, Departure Clearance(DCL) and Data link Automatic Terminal information Service (D-ATIS) has been provided in 60 airports.
- 134 airports offer D-CDM services (based on ACARS ATS)

EN-ROUTE:

- CPDLC and ADS-C services (FANS 1/A).
 - The RCP240/RSP180 standards of PBCS.
 - Lanzhou and Urumqi Flight Information Regions (FIRS) since 2000.
- D-VOLMET services have been provided since October 2020.



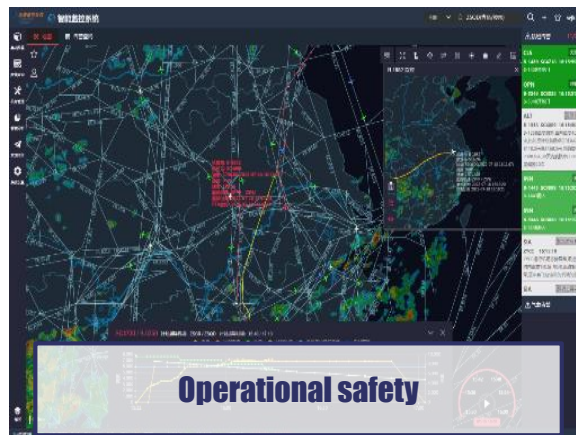
Datalink Application & Service for Airline

Ground Application Integration Solution (SkyLink 5.0)

- SkyLink has been applied to **ALL 65** airlines in China, including:
 - Datalink Message Processing (SkyCenterManager)
 - Flight Tracking and Monitoring Service (SkyView)
 - Aircraft condition monitoring system (SkyMon & SkyCFD)
 - Flight Operation Quality Analysis Service (SkyFQM)
 - Ground service supporting system (SkyCourier)
 - Automatic Information service for transfer passengers (SkyTransfer)

SkyView

Flight Tracking and Monitoring Service



SkyFQM

Flight Operation Quality Analysis Service



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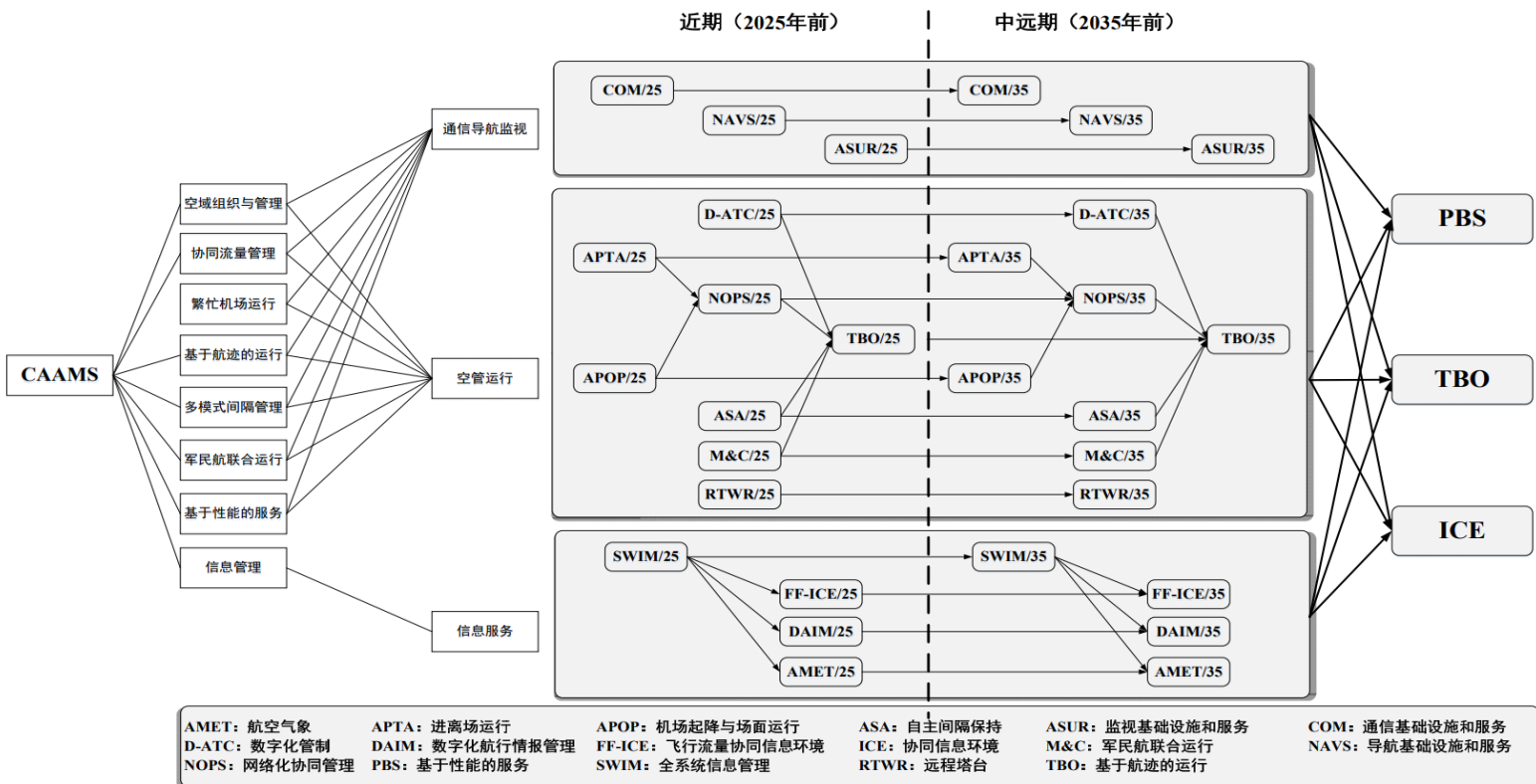
A/G Connectivity Solutions for TBO

TBO in China

Civil Aviation ATM Modernization Strategy

TBO in Civil Aviation ATM Modernization Strategy (CAAMS)

- TBO is one of the three essential concepts in CAAMS:
 - Plan to 2025: Small-scale tests and validations of TBO
 - Plan from 2025 to 2035: Construction of FF-ICE, TBO environment to enable large-scale application.

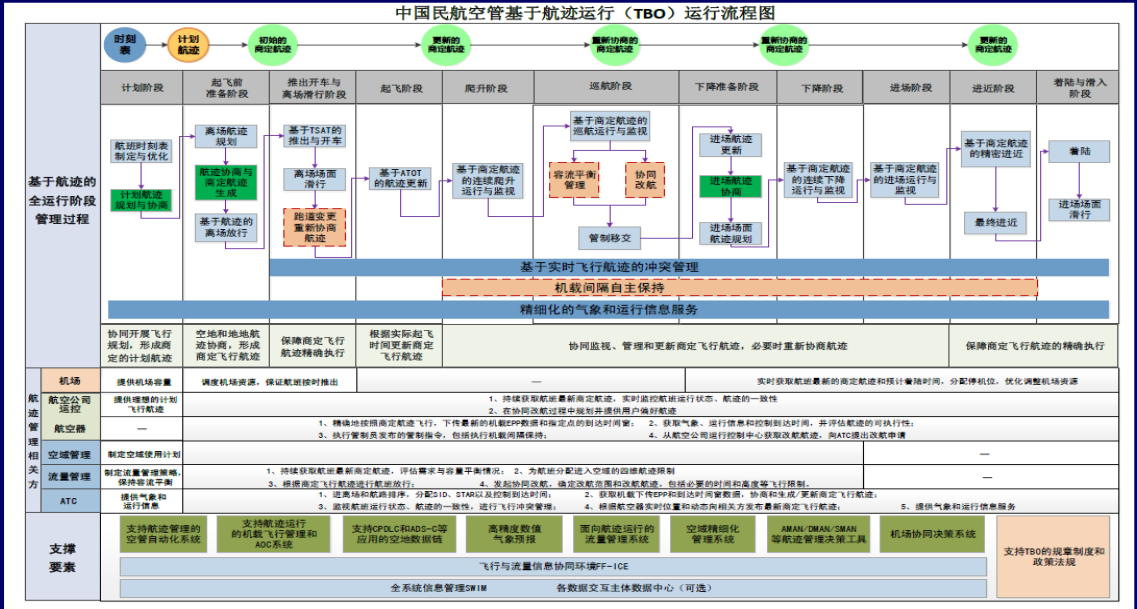


TBO in China

TBO Concept

CAAC TBO ConOps Released in May, 2020

- TBO Concept
 - Towards the use of a shared trajectory, efficient collaboration as the basis for decision-making across the ATM System Participants.
- Three major changes
 - United situation awareness
 - Collaborative management of trajectory through whole process
 - Precise operation

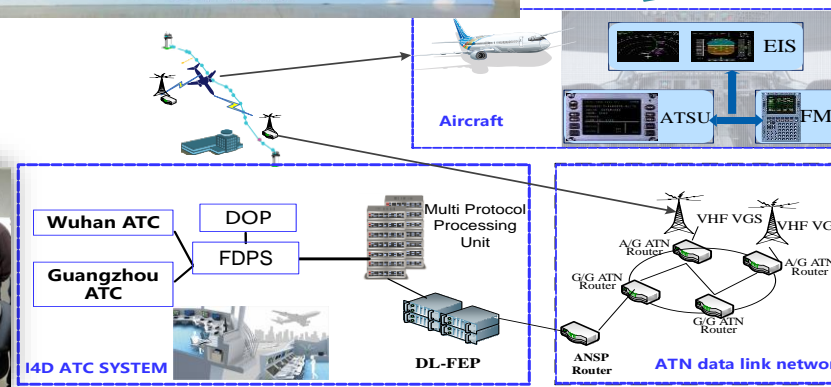
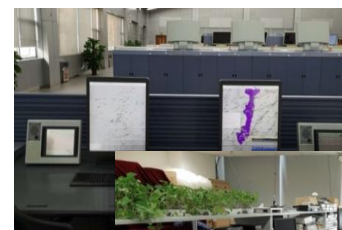
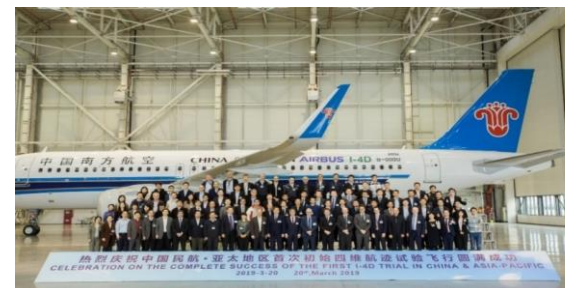
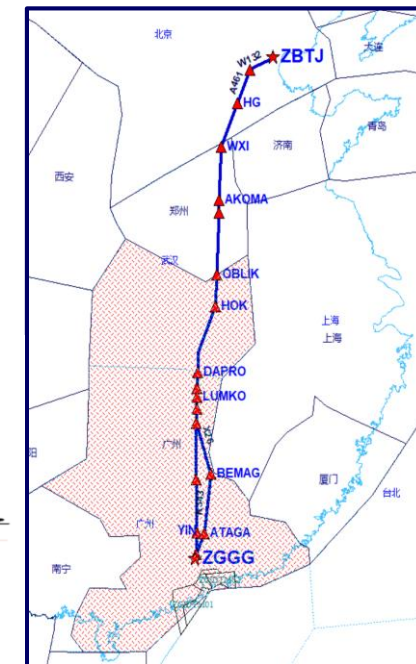
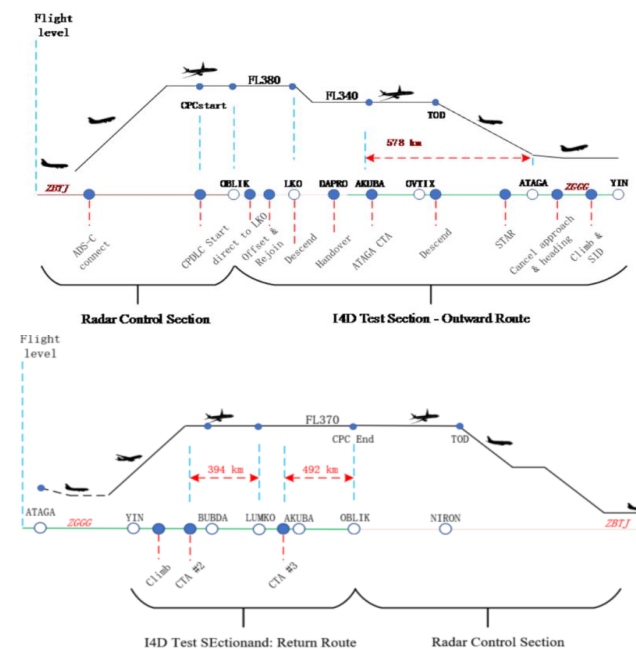


TBO in China

I4D Flight Trial base on
FANS 3/C

I4D Flight Trial

- Flight Date : 03/20/2019
- Trial Scenario :
 - Route: Tianjin-Guangzhou
 - Area: Guangzhou ACC & APP
 - Test Items :
 - CPDLC/ADS-C
 - RTA
 - EPP



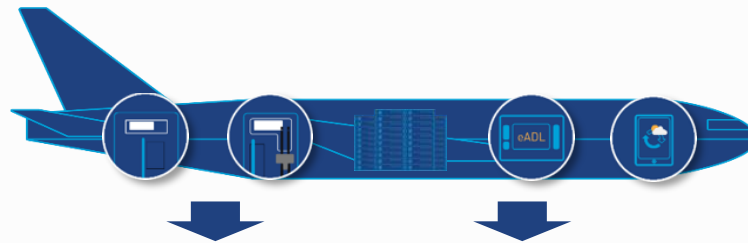
A/G Connectivity Solutions for TBO

1. Using existing avionics system to achieve initial TBO

- Utilize **existing airborne equipment capabilities** (FMC WPR/FPN - ACARS ATS) to achieve initial TBO, no airborne equipment modifications required.

Trajectory Sharing

Real-time downlink flight trajectory prediction calculate by FMS - FMC WPR (ACARS ATS)

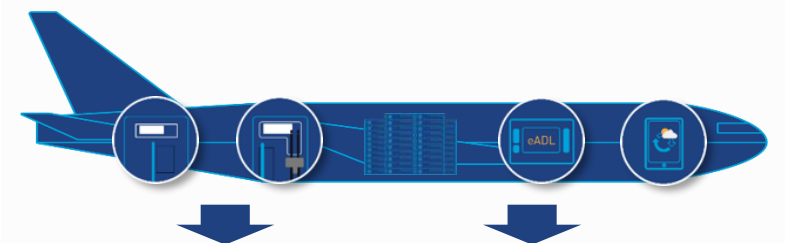


1. Current Position N4726.1 W12218.5	} Downlink flight trajectory calculate by FMS
2. (Crossed) Waypoint Ident SEA	
3. Greenwich Mean Time 09:31:18	
4. Current Altitude FL350	
5. Goto (Next) Waypoint Ident ORTIN	
6. ETA at Goto Waypoint 09:34:36	
TUSLIR30-,084532,268K,3310,262,M60,281032,432,N,101,43.	
KARVIR30-,090206,268K,3310,247,M60,281032,432,N,062,126.	
.....	

Integrate with ground ATC systems to improve aircraft forecast arrival accuracy, enhancing flight safety and airspace utilization

Crew's Intent Sharing

Real-time downlink crew's intent from FMS (active route) - FMC FPN (ACARS ATS)



Company Route

SID

STAR

Dep Runway

Arr Runway

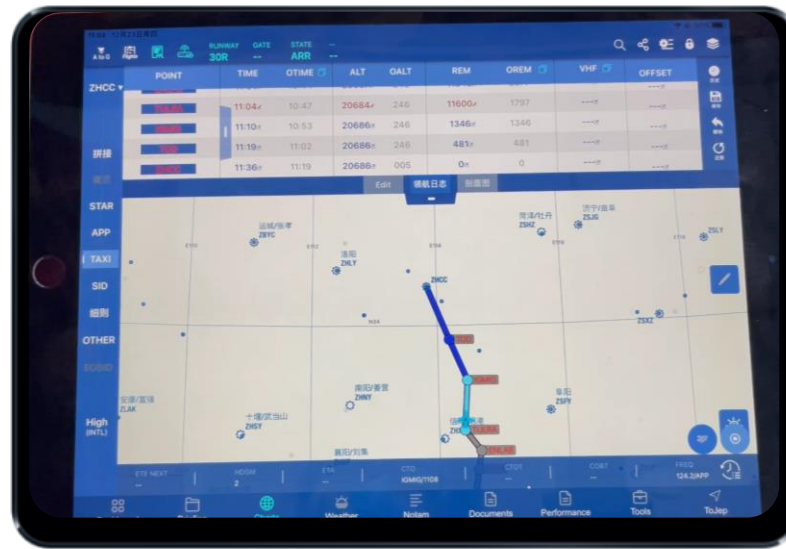
Flight Plan

Downlink crew's intent, compare with ATC controller's instruction to identify potential conflicts & enhance safety

Over **12** months of flight validation has been conduct, **>50% of existing** aircraft in China's civil aviation has FMC WPR/FPN capability, **able to achieve the initial TBO services.**

A/G Connectivity Solutions for TBO

2. Using Crew Side AID-EFB as TBO Enhancement System

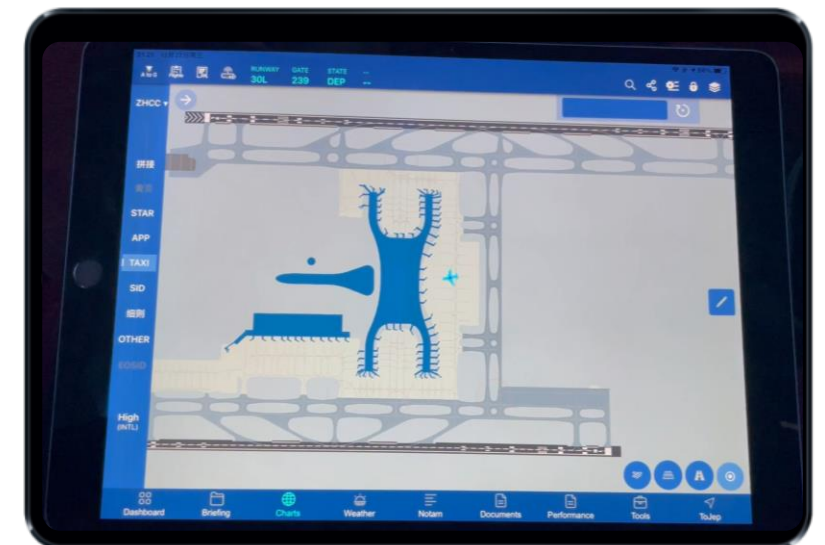


Air

- Route alert, hazardous weather / NOTAM warning
- Graphical display STAR, frequency, CTO, ETA, CTOT/COBT, taxi route and provide taxi guidance based on current position

Ground

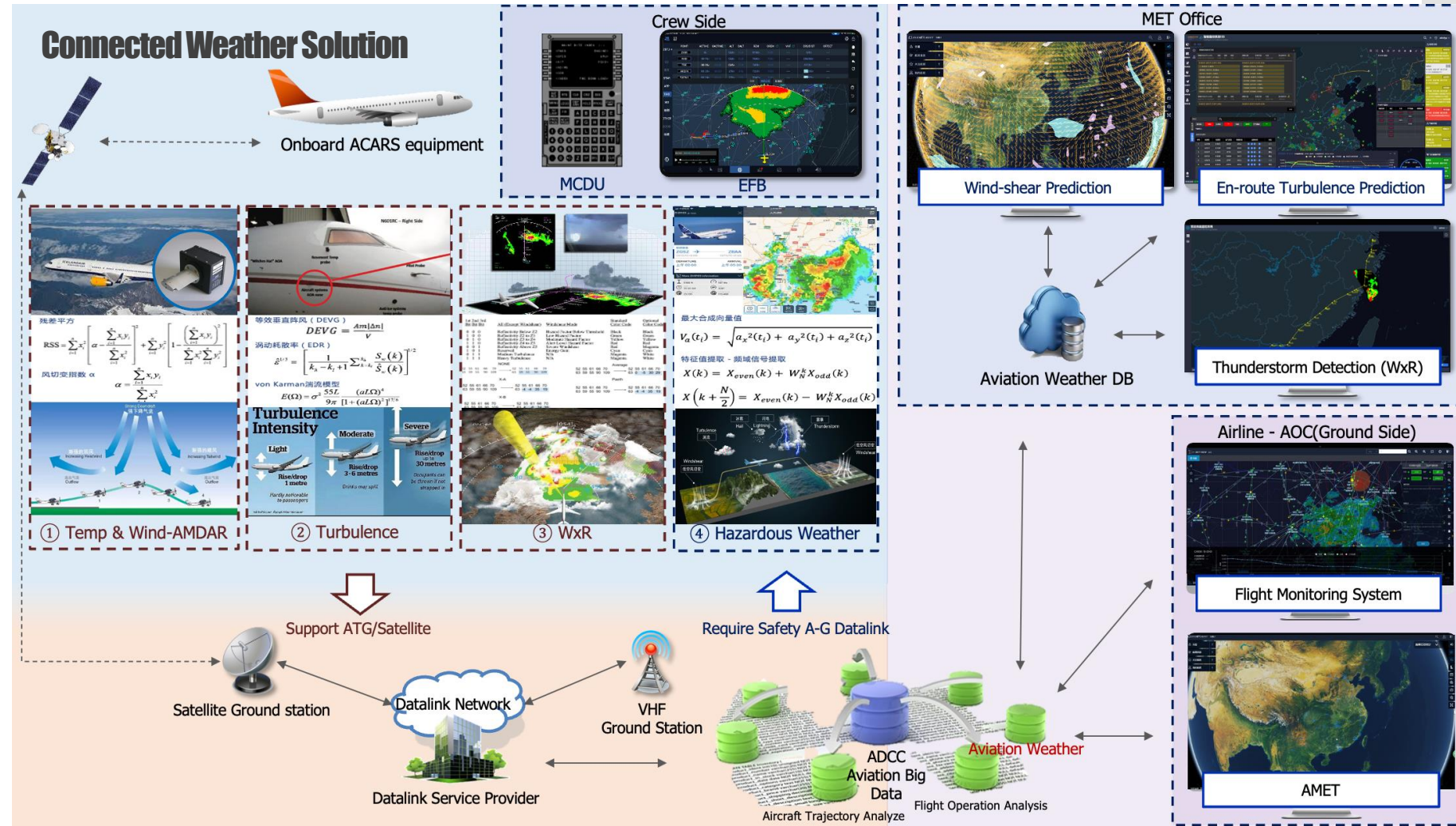
- Automatic pushing ATC released STAR, frequency, CTO, ETA ,taxi routes & CTOT/COBT to flight crew EFB based on datalink



A/G Connectivity Solutions for TBO

3. Connected Weather

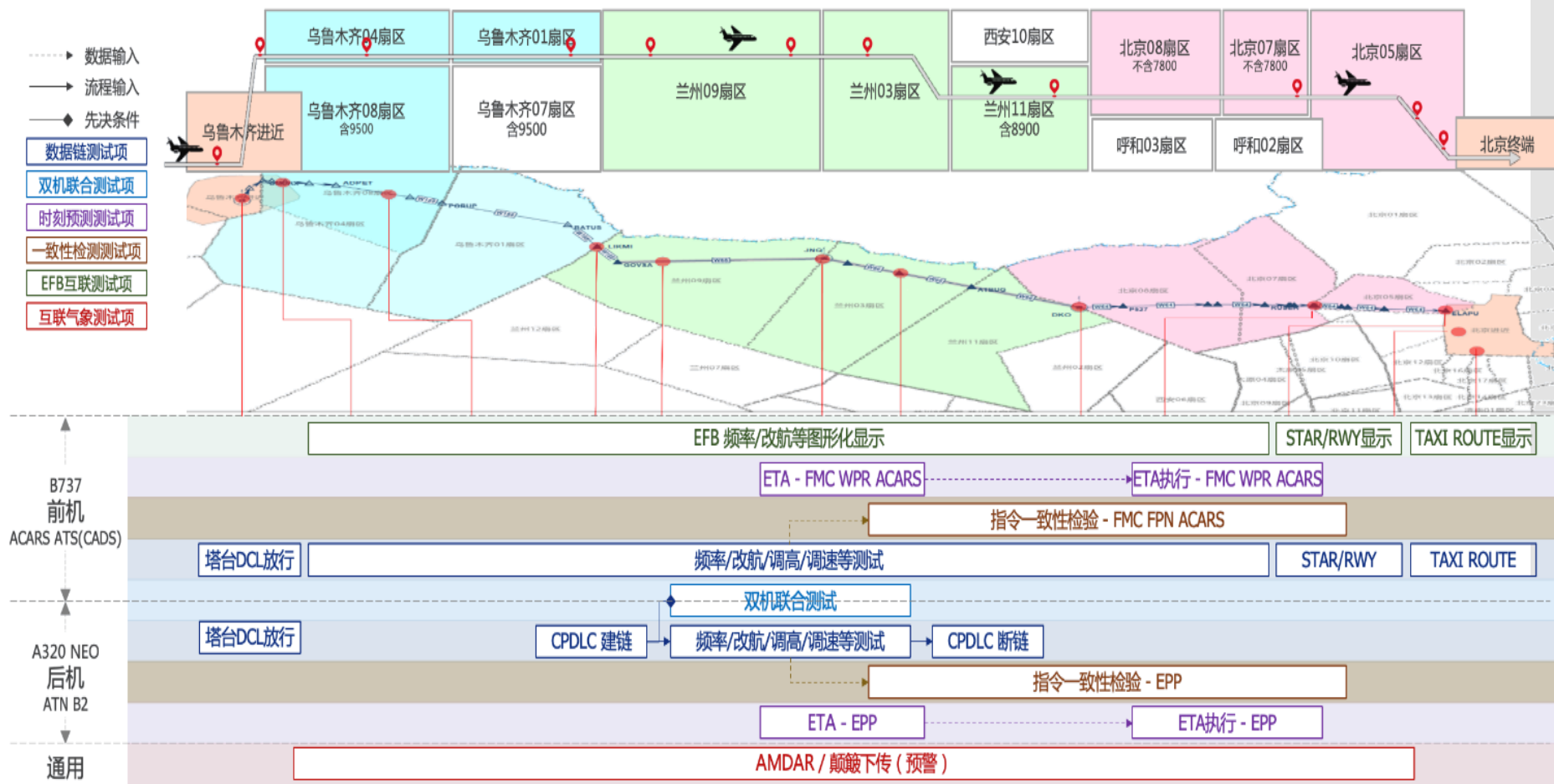
- Aircraft as a sensor, real-time downlink meteorological snapshot' (e.g. AMDAR, turbulence, & avionic WxR data), generate hazardous weather warning & publish to connected EFB



Next Step

TBO Flight Trial with 2 A/Cs

- CAAC Key Task in 2024 : TBO Flight Trial with 2 Aircrafts From Urumqi (ZWWW) to Beijing (ZBAD).



Next Step

TBO Pathfinder Project

- “On 23 October 2023, ten signatories comprising the air navigation service providers (ANSPs) from China, Indonesia, Japan, New Zealand, the Philippines, Singapore, Thailand, and the United States, the Civil Air Navigation Services Organization (CANSO), and the International Air Transport Association (IATA) signed an agreement on the Asia-Pacific Trajectory-Based Operation (TBO) [Pathfinder Project](#), to [jointly define, develop, and demonstrate TBO for the Asia-Pacific region within four years.](#)”



TBO Implementation Strategy

TBO Implementation Strategy

- By Phase of Flight: Pre-departure, Departure, Climb, En-route, Descent, Approach, Landing, etc.
- By Task: CM, TS, DCB, AO, AM, etc.
- Mix Operation of TBO and Non-TBO
- Technology Evolution Strategy :
 - A/G ATN
 - Information Management Infrastructure
 - ATM Automations
 - Avionics Upgrade

THANK YOU!

Aviation Data Communication Corporation (ADCC)

Zhu Yanbo