



A Decade of A-CDM Best Practices and Future TAM Outlook

Bangkok, April 2026



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1

A-CDM Theory and Development

ICAO ASBU A-CDM

ACDM-B0/1	Airport CDM Information Sharing (ACIS)	Operational	  
ACDM-B0/2	Integration with ATM Network function	Operational	  
ACDM-B2/1	Airport Operations Plan (AOP)	Operational	  
ACDM-B2/2	Airport Operations Centre (APOC)	Operational	  
ACDM-B2/3	Total Airport Management (TAM)	Operational	  
ACDM-B3/2	Advanced total airport management (TAM)	Operational	  
ACDM-B3/3	Extension of Advanced TAM to integrate AI/ML	Operational	  
ACDM-B3/4	Extension of Advanced TAM to integrate new entrants	Operational	  
ACDM-B4/1	Full integration of ACDM and TAM in TBO	Operational	  

<https://www4.icao.int/ganpportal/ASBU>



ICAO

Regulation and Standards

ICAO DOC 9971

Flight and Flow Information for a Collaborative Environment, FF-ICE

Provide guidance on information exchange for collaborative air traffic flow management.

1. Defining the technical environment and requirements for flight and flow information in a collaborative environment.
2. Introducing information needs for pre-tactical operational planning and collaborative decision-making processes.
3. Detailing technical specifications for information exchange, such as trajectory data elements, performance parameters, etc.
4. Providing technical recommendations to enable system interoperability.

ICAO DOC 9750

The "Global Air Navigation Plan" (GANP), which outlines the Aviation System Block Upgrades (ASBUs) as part of ICAO's strategic approach to increase operational and environmental efficiency and capacity of the global air navigation system.

1. The GANP introduces the ASBU methodology, which is a set of modules organized in flexible and scalable blocks that can be implemented based on the operational needs of a State or region.
2. The ASBU modules provide a comprehensive systems engineering modernization strategy for the aviation community to ensure coherent and harmonized development of the air navigation system.

A-CDM Addresses Operational Challenges

1. Digitization of time nodes in the flight operational lifecycle
2. Data sharing
3. Management of key milestone time nodes
4. Ground and airspace coordination
5. Minimizing losses during widespread delays
6. Enhancing temporary runway capacity
7. Accurate pre-departure sequencing
8. Reducing change of aircraft stand allocation
9. Taxiing time prediction

VariFlight

The Development of A-CDM Standards for CAAC

- Based on rich practical experience, VariFlight, with the support and guidance of CAAC, took the lead in drafting the industry standards for Airport Collaborative Decision Making (A-CDM), which were officially implemented in March 2022.
- In September 2024, cooperate with CAAC to revise the ICAO Manual on Collaborative Air Traffic Flow Management (Doc 9971).

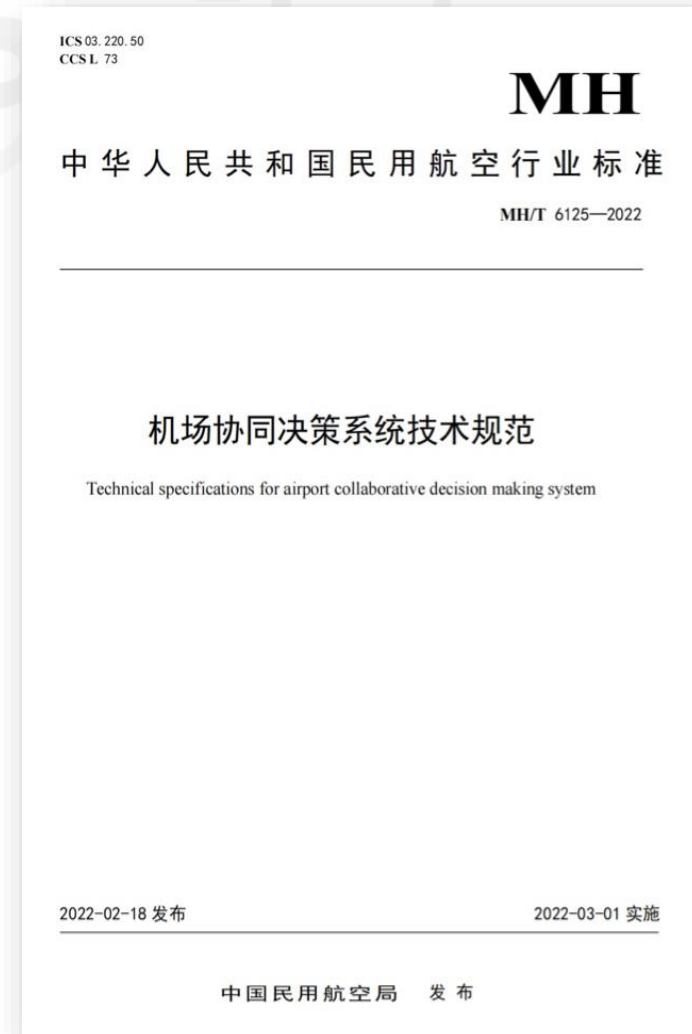
45

Mandatory Timenode
Milestones

The standard of A-CDM in China

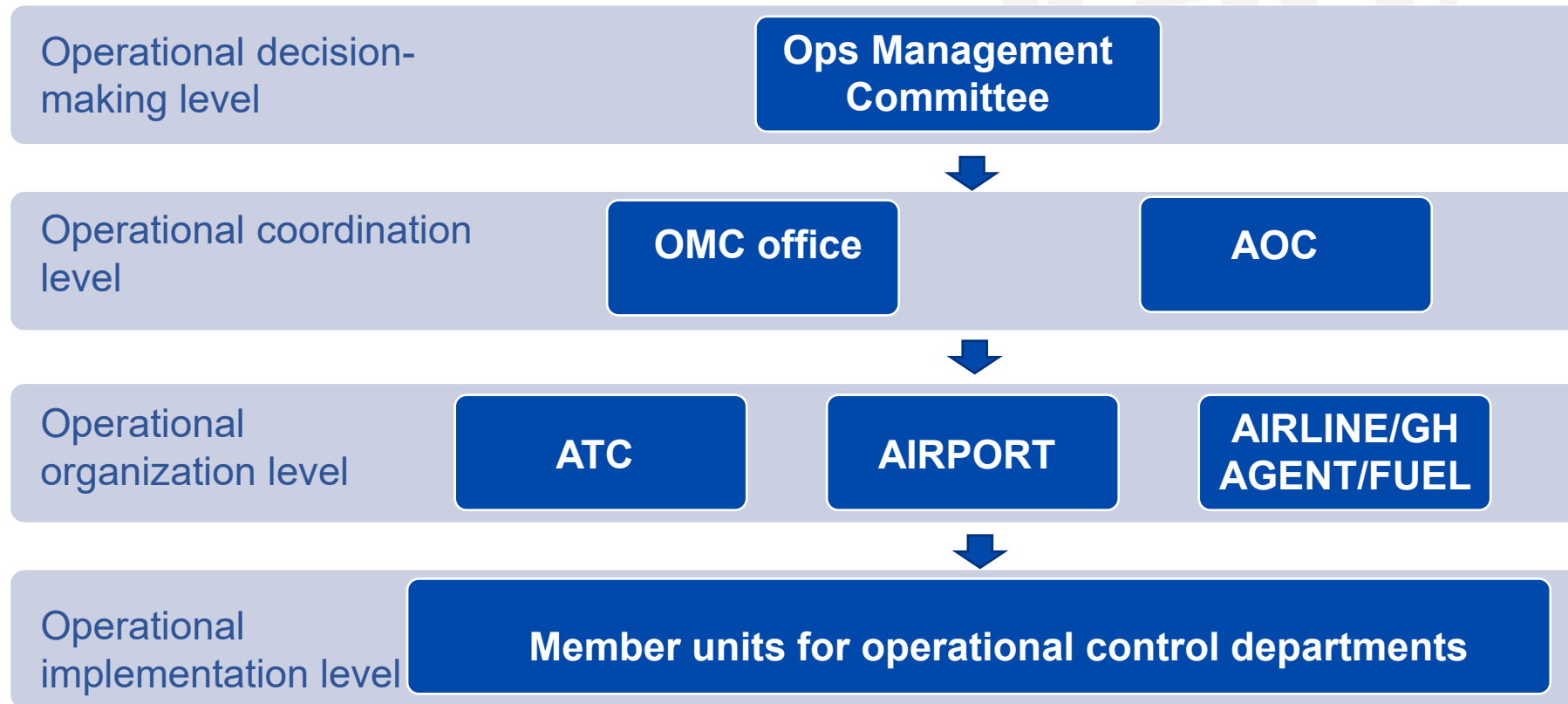
16

Timenode
Milestones
The standard of A-CDM in
Europe



Guarantee the Organizational System of OMC

A system can not get the value without a supporting management structure



OMC: The Operations Management Committee

Improve On-Time Performance by Securing SLOT

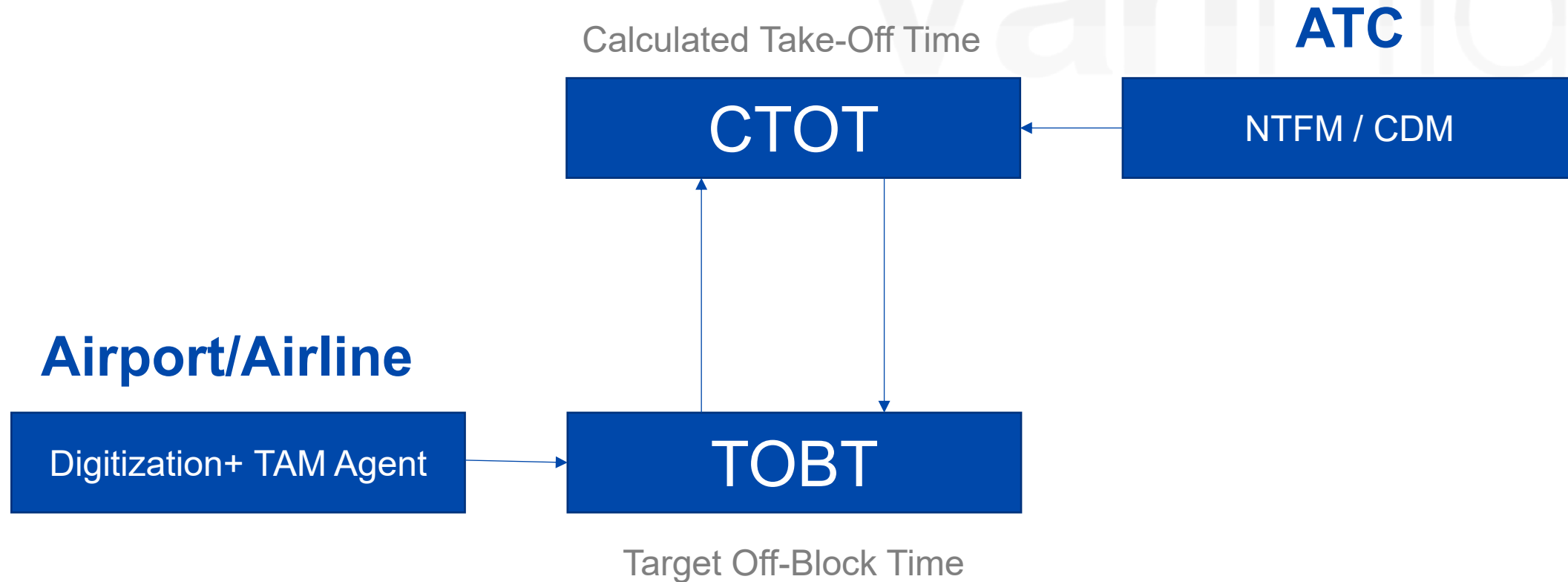
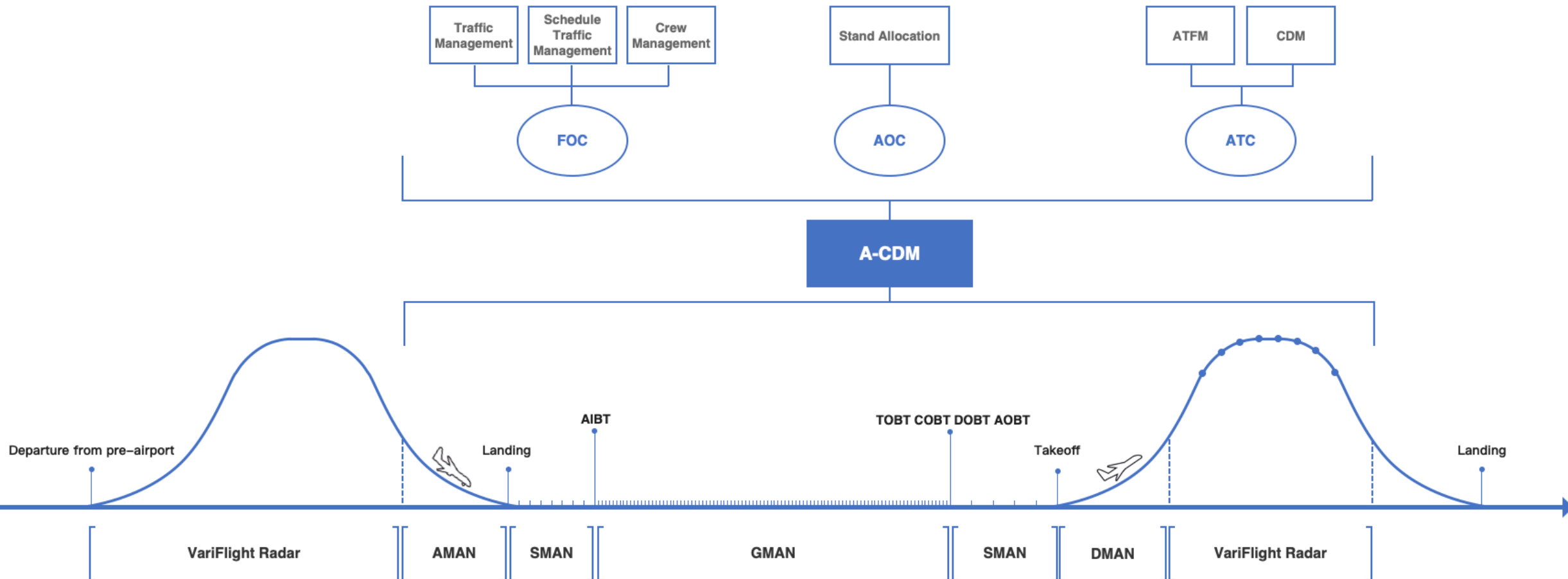


Diagram of A-CDM Digitalization Principles

By digitizing each stage and enabling seamless collaboration between air traffic control and airlines at key moments, on-time performance can be improved, ultimately expanding airport slot capacity.



PERCEPTION

- Enhance Airport Capability for Visualized Monitoring

- Establish connectivity among multiple users and systems by integrating underlying data, thereby breaking down "information silos" between different elements.
- By leveraging visualization technologies, establish an integrated platform for operational activities, enabling comprehensive displays of the entire airport operation scene, complete restoration of all elements, and end-to-end process tracking. Data is presented in sync, encompassing both temporal and spatial dimensions, to gain a comprehensive understanding of the changing trends in data.



Operational Situation Overview

Flight Zone

Terminal

PERCEPTION

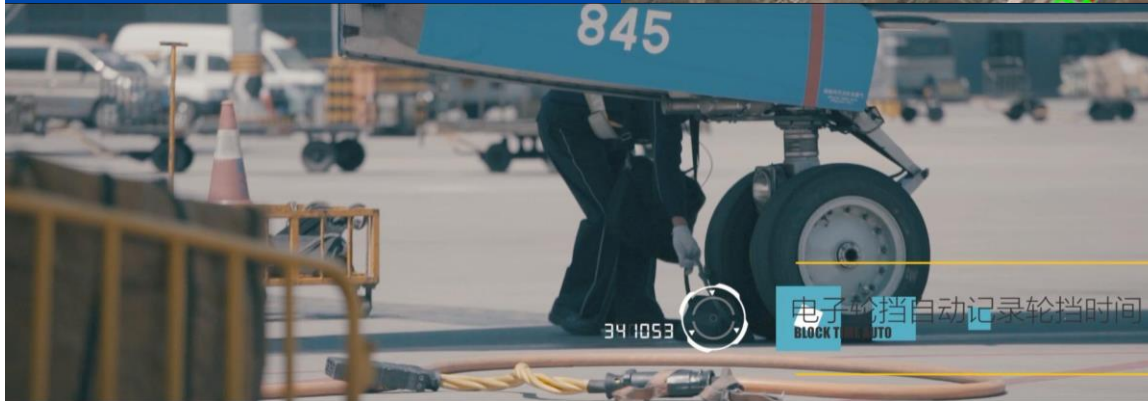
- IOT Self-built Data System



Video data is converted into time data



Spatial data generation time data



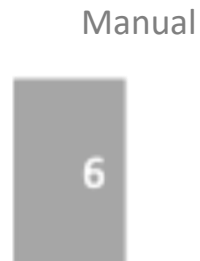
IOT devices provide time data.



PERCEPTION

- Enhancing Airport Perception Capabilities

Utilising Technologies such as IoT and Intelligent Video Analytics



Digitalization capabilities keep growing

Flight operation & security

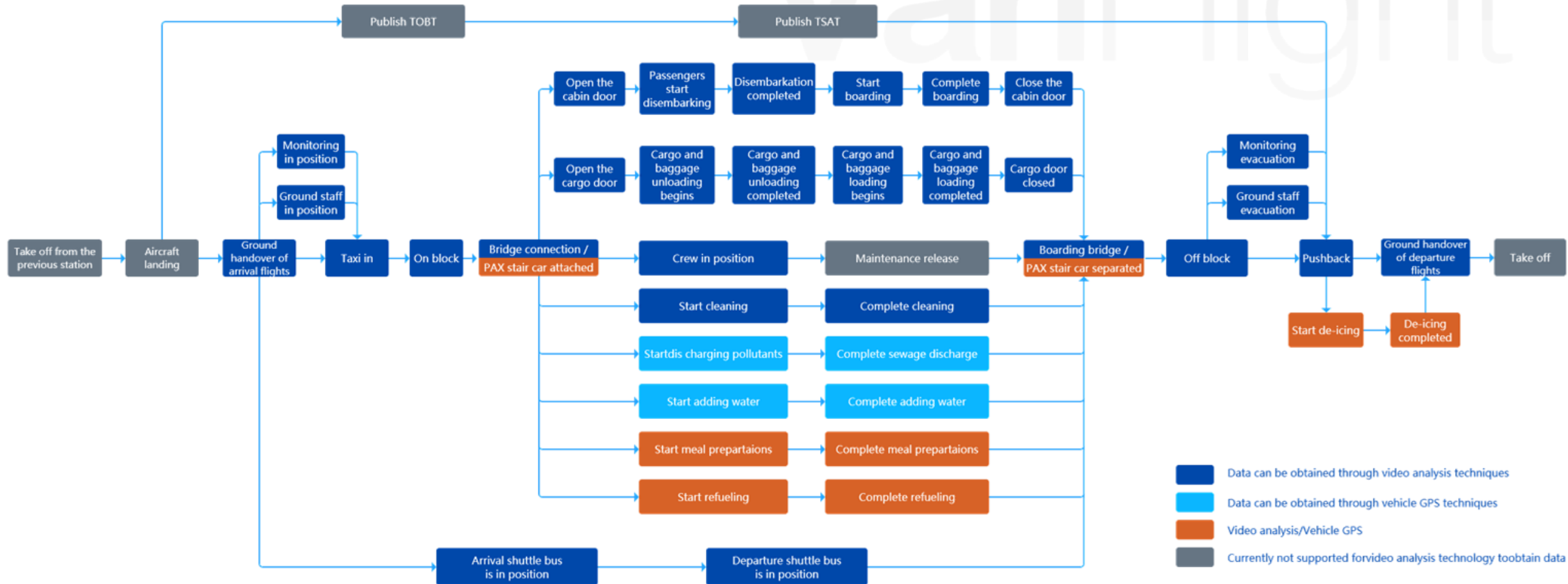
Milestones



PERCEPTION

- Ensure the Type of Node Collection

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PERCEPTION

- Algorithm Recognition Ability Indicators

- The comprehensive accuracy of identifying nodes with objects (such as aircraft and bridges) is over **98%**
- Identifying nodes related to targets and characters (such as clothing) with a comprehensive accuracy rate of over **95%**



Automatic Identification of Facility and Equipment Connection

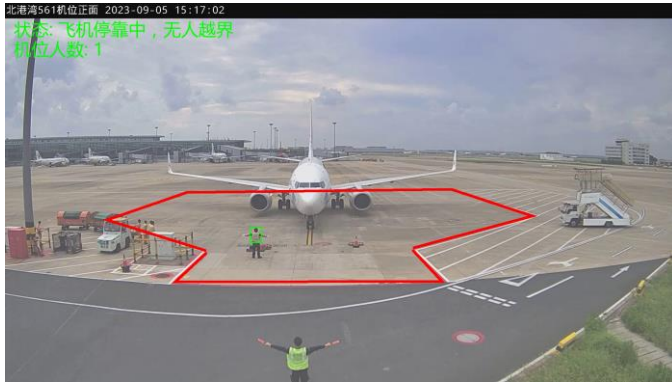
Realize automatic identification of connection status of equipment such as air conditioners

1. Early warning of high energy consumption connections such as aircraft overnight air conditioning
2. Automatic identification and docking of charging guarantee nodes for financial settlement



PERCEPTION

- Apron Safety Incident



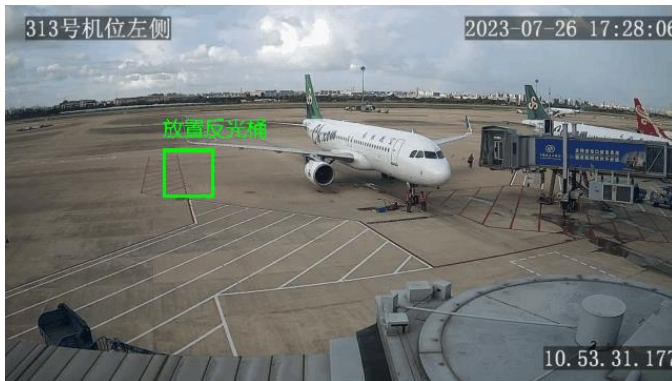
No crossing boundaries before plane stops



Air bridge operator in position



Evacuate the corridor bridge to the return point



Place the reflective cone bucket in time



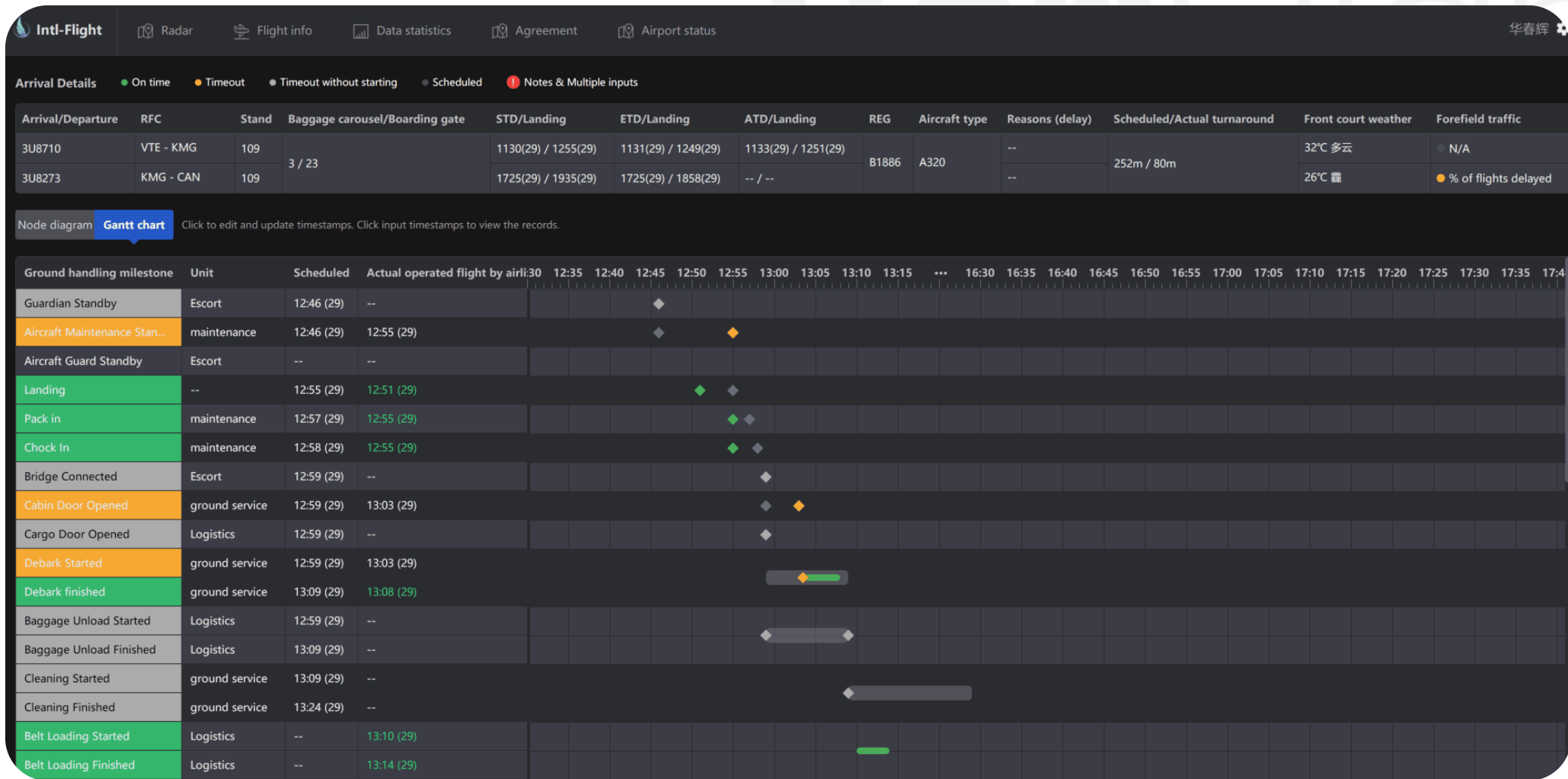
Personnel wearing reflective vests



Supervised during the docking of passenger elevator vehicles

Decision Making

- Management of Key Milestones in A-CDM



Decision Making - Collaborative Release

序号	航班号	限制内容	限制条件	预计起飞时间	限制生效时间	限制	是否有效	限制原因	是否禁止放行	航班状态
001	TOLAK	TOLAK: M50请提前离港放行。		2019-01-28 00:28	2019-01-28 11:20	放行	是	无	0 1 0	17
002	LJO	LJO: A470822快通【烟台 青岛】100秒 1030---		2019-01-28 09:20	2019-01-28 11:00	放行	是	无	0 1 0	1
003	KUBA	KUBA: W598请【成都双流】(1512) MT: 60公里 (间隔不限) 1045-1315		2019-01-28 09:25	2019-01-28 11:15	放行	是	无	0 1 0	3
004	FYG	FYG: 拉萨机场【20%高炮】15分钟 会定空 1910-1210		2019-01-28 09:30	2019-01-28 09:47	放行	是	无	0 1 0	9
005	FYG	FYG: 会定限制【20%高炮】(1512) MT: 50公里 (55分钟, 0900-1100) ; 7800一个高度 (40秒, 1100-2300)		2019-01-28 07:00	2019-01-28 11:26	放行	是	无	0 1 0	3
006	BEOMO	BEOMO: 温州温州机场航空【浦东-温州】放行		2019-01-28 09:20	2019-01-28 09:50	放行	是	无	0 1 0	1
007	TOLAK	TOLAK: M50请提前离港放行放行。		2019-01-28 07:25	2019-01-28 11:20	放行	是	无	0 1 0	9
008	PSB	MR-PSB: 天津南石家庄至张家口, 济南区域落地 60秒 (0700-0800)		2019-01-28 07:04	2019-01-28 10:35	放行	是	无	0 1 0	9

TOBT automated calculation

Based on complete flight process data, TOBT can be automatically calculated. After manual confirmation, it can then interact with CDM to obtain the COBT and CTOT. These timings are used for visualizing the sequencing of flight clearances, ensuring smooth operations.

NO. FLT	TAR	IDE	RWY	SOBT	ACOBT	DICTOT	LTOF	TL	放行
1	CA492	593	CTU	35R	0920	0938	-9	0950	许可开车
2	HK235	581	HKD	34L	0910	0940	-1	0940	许可开车
3	CA1956	595	TSN	35R	0850	0941	-21	0920	许可开车
4	FM885	518R	KUL	34L	0920	0945	-28	1907	许可开车
5	MU5699	308	LURC	35R	0915	0947	-4	0945	许可开车
6	CA1966	616	WNZ	34L	0935	0950	-24	1905	许可开车
7	FM875	145	MFM	34L	0925	0950	-14	0955	许可开车

Enhanced on-time clearance rate

The system automatically analyzes the affected flights based on the restrictions information provided by CDM. Additionally, the system calculates the critical threshold for departure delay based on pre-set criteria for flight punctuality assessment. For flights predicted to potentially experience delays, automated alerts are generated, and prompt manual coordination and resolution to take place. The aim is to salvage critical flights, thereby improving overall flight regularity and departure efficiency.

Decision Making

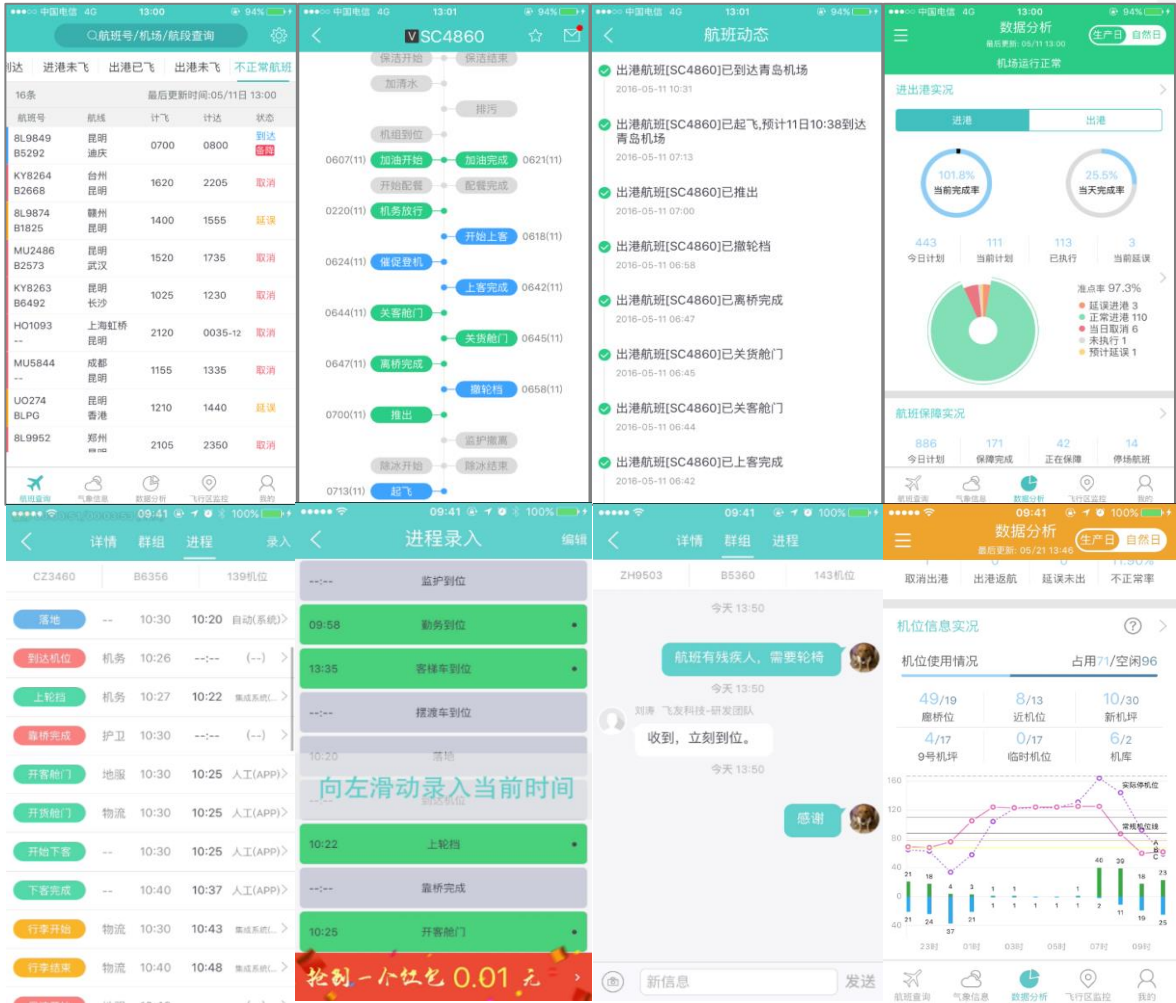
- Enhanced Capability to Adjust Flight Schedules

By analyzing schedules in advance, implementing peak-hour spreading, and dynamically adjusting flight timings, the regularity of schedule adjustments can improve by nearly 10% compared to not making any adjustment.



Execution

- Enhanced Operational Mobility



Support mainstream mobile operating systems

Harmony OS, Android, and iOS

Mobile-enabled production and operational data

Provide functionalities such as quick flight search, flight group messaging and task reminders, message subscription notifications, airport weather inquiry, operational data statistics, flight radar monitoring, etc., to achieve mobile-enablement of production and operational data. This addresses the issue of comprehensive coverage in two-way information transmission.

Execution

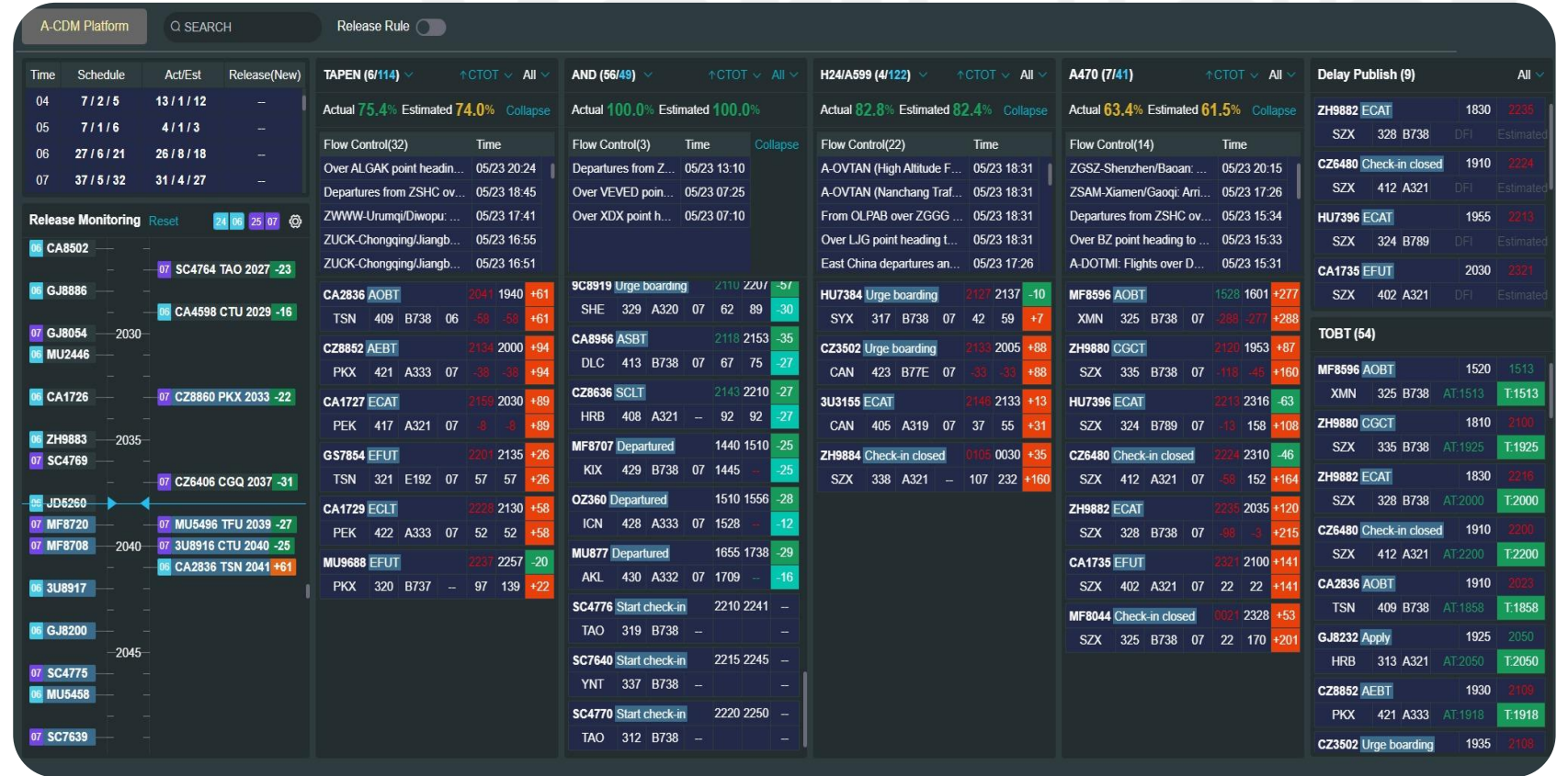
- CDM Progress Strip

Route monitoring

Hourly capacity monitoring

TOBT management

Delayed flight management



Execution

- Digital Apron

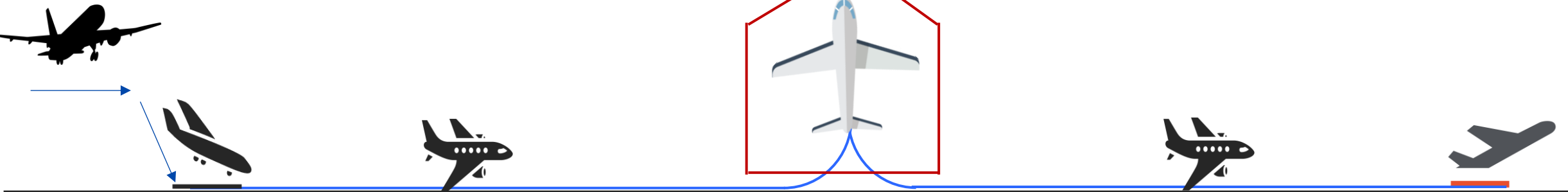
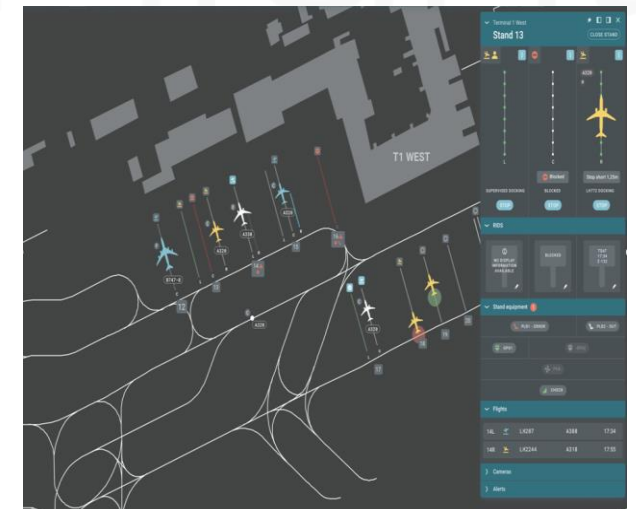
Important node information



Aircraft occupancy status, aircraft entry/departure time, up/down block time



Push-out management alarm is not pushed out after timeout





2 A-CDM Case Study in China

Case Study 1: China first A-CDM enabled smart airport Kunming International Airport (KMG)

Achieved highest **On Time Departures**
for >10M class airports in China

Ground Handling Time
reduced by 20%

Airport receives **accurate ETA**
(where 97% of arrivals
fall within +/-1min)

Airport reports
65% reduction
in phone call enquiries

23% Reduction on
Airlines' Diversion & Air Turnback

Support **81 Milestones**,
far exceeding 16 milestones
recommended by EuroControl

Reduced aircraft taxiing
Up to **240km/day**

Case Study 2: Benefits of A-CDM Shanghai Pudong International Airport (PVG)

Global Situation Visualization



Runway Monitoring

Resources Monitoring

Operational Situation

ADS-B

Apron Monitoring

Gate Conflict Warning

Tug Dispatching

Intelligent Stand Allocation

Statistical Analysis

**Intelligent Dispatching
Collaborative Operations**

Collaborative Departure

Milestone Management

Pre-Tactical Management

Runway Sequencing

Normal Release Rate **25%** ↑

Ground Handling Time **20%** ↓

88% Flights' ETA Discrepancy **<1 min**

Efficiency

Safety

Experience

Coordinating Flight Delays **10%** ↓

Extra **+30 min** Preparation Time

Airport PLB rate **10%** ↑

Case Study 3: Benefits of A-CDM

Hangzhou International Airport (HGH)



TOBT automated interaction **99%**



Revise short-delay flights **1,892**



Optimized **5 flight schedules** during seasonal transition

Enhancement of operational efficiency **30%**

Enhancement of flight punctuality **5.5%**

Enhancement of flight re-timing punctuality by **10%**

Developing an integrated command and control platform for operations



Integration of different system between ATC, airport and airlines

Integration of operational data to connect different domains such as flight, passengers, weather..

TOBT automated calculation to enhance flight punctuality

NTFM

AIRLINE

ADS-B

DEPARTURE

PRODUCTION SYSTEM

.....

Case Study 4: First Airline to adopt GMAN SiChuan Airline (3U/CSC)



Task idling time
reduced by **15-20mins**



Production efficiency
improved by **40%**



Communication efficiency
improved by **30%**

Ground handling tasks

Coverage **100%**

Data Accuracy **99%**

90% ETA error **± 1 min**

Data Latency **<30s**

Enabling near real-time update

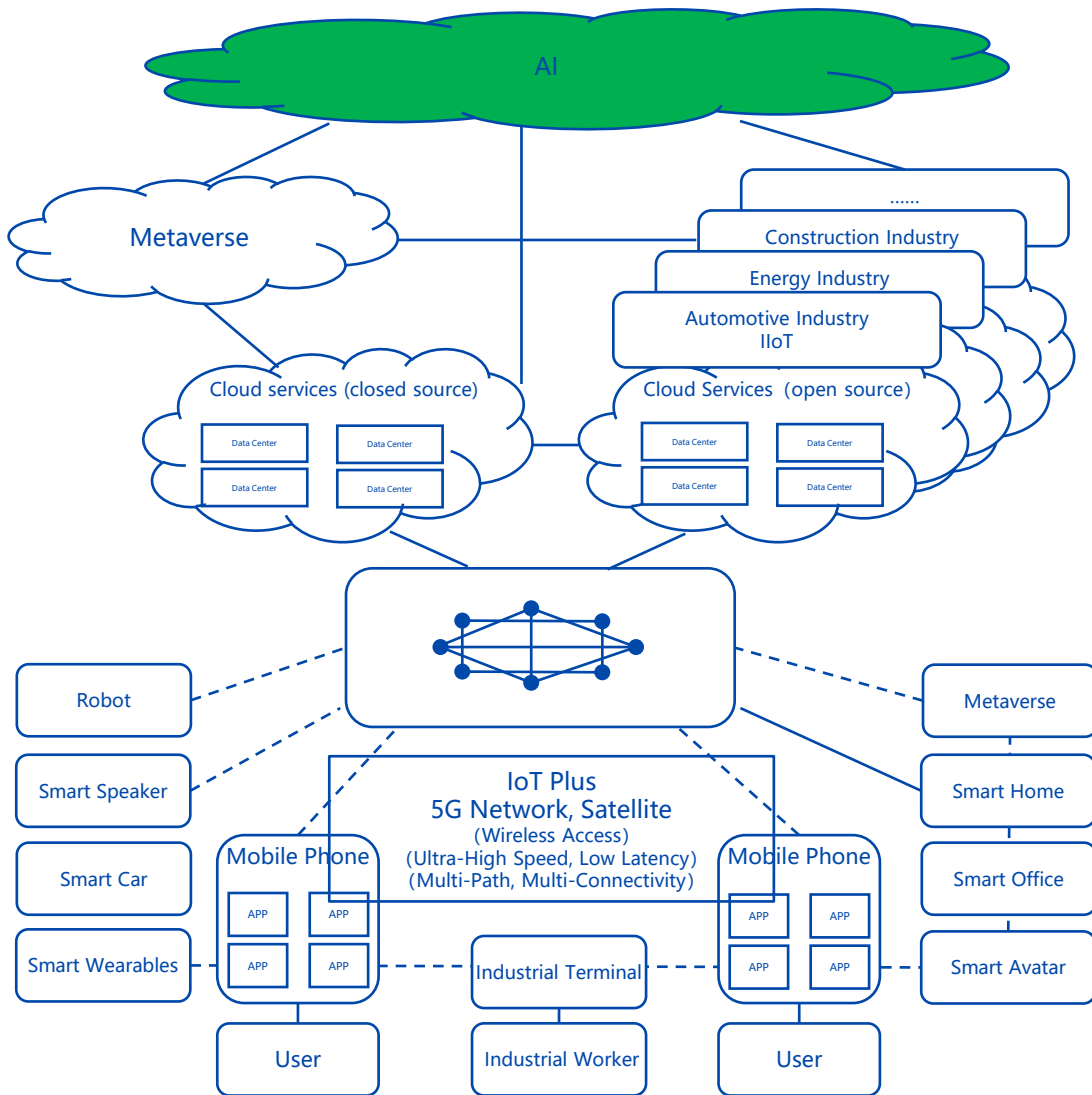


A large white commercial airplane is parked on a tarmac under a cloudy sky. The aircraft is viewed from a low angle, showing its wings, engines, and tail. The background is a bright, overcast sky with scattered clouds. The foreground is a grey asphalt surface.

3

Future TAM Outlook

AI Opportunities



This site quizzes 9 Verbal & 4 Vision AIs every week | Last Updated: 11:08AM EDT on September 14, 2024

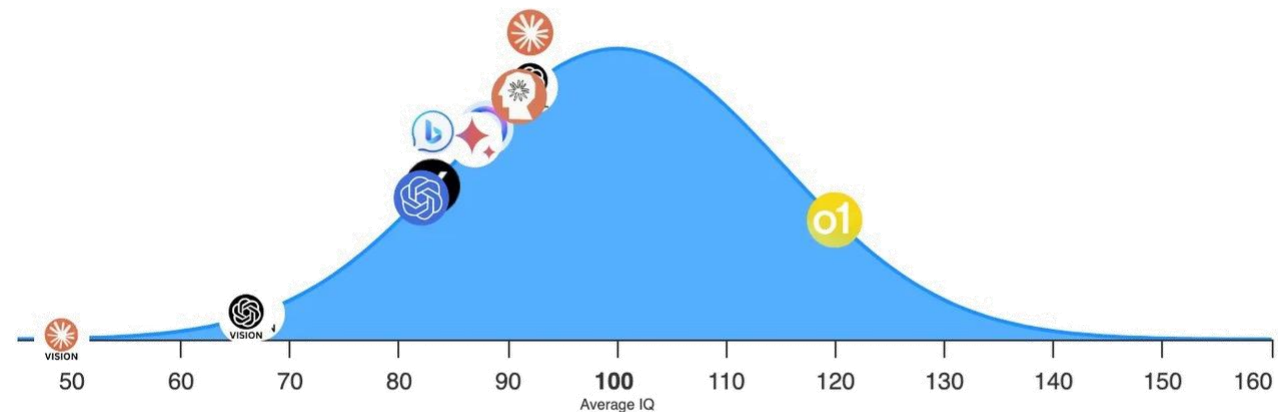
IQ Test Results

Score reflects average of last 7 tests given

Reset

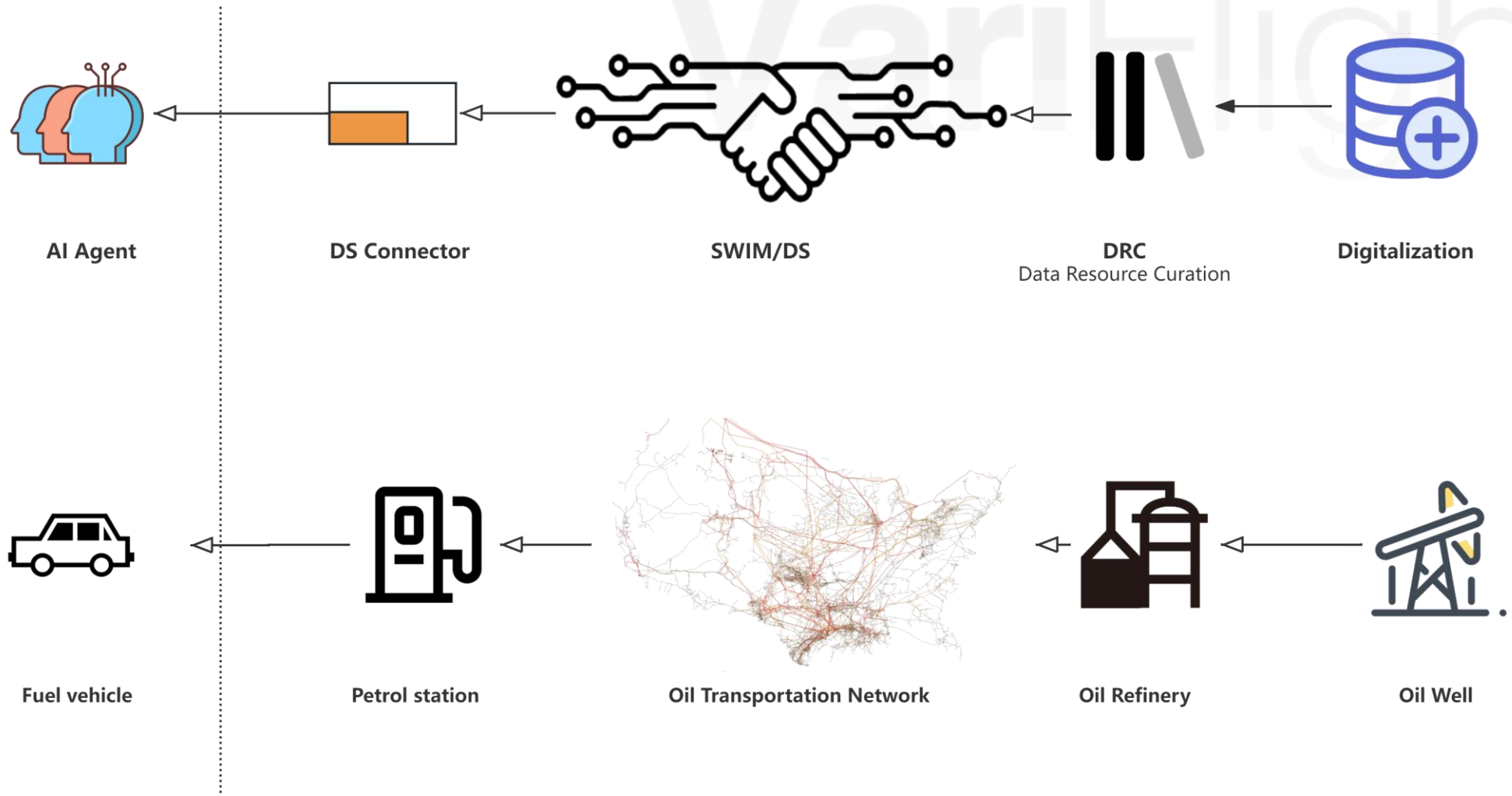
Show Offline Test

Show Mensa Norway

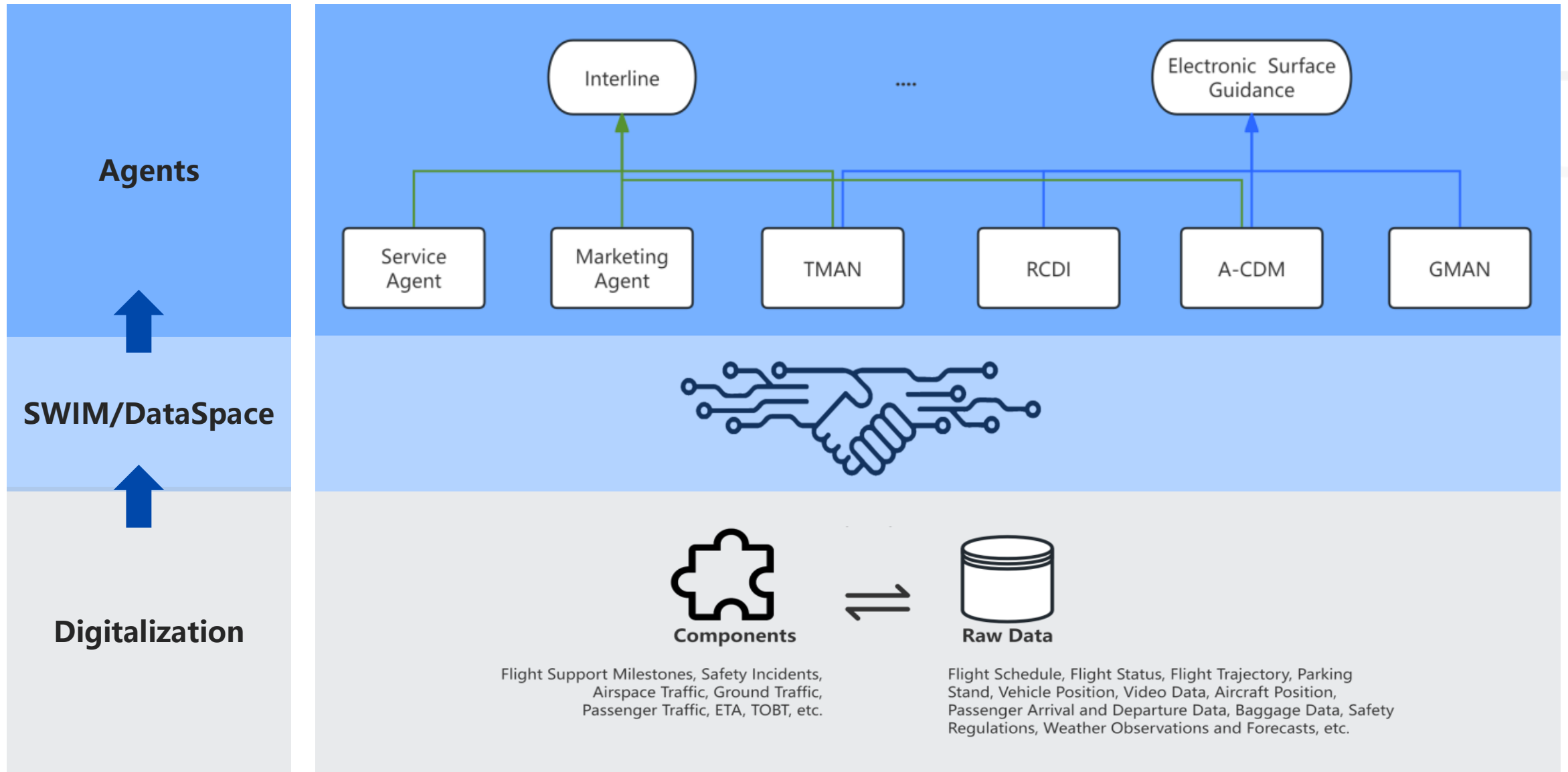


- OpenAI o1 preview
- Llama-3.1
- Grok-2
- Gemini Advanced (Vision)
- Gemini Advanced
- GPT4 Omni (Vision)
- GPT4 Omni
- ChatGPT-4
- Bing Copilot
- Claude-3.5 Sonnet
- Claude-3 Opus
- Claude-3 Opus (Vision)

Data — The Indispensable Fuel for Civil Aviation AI



Total Airport Management (TAM)-Technical Roadmap



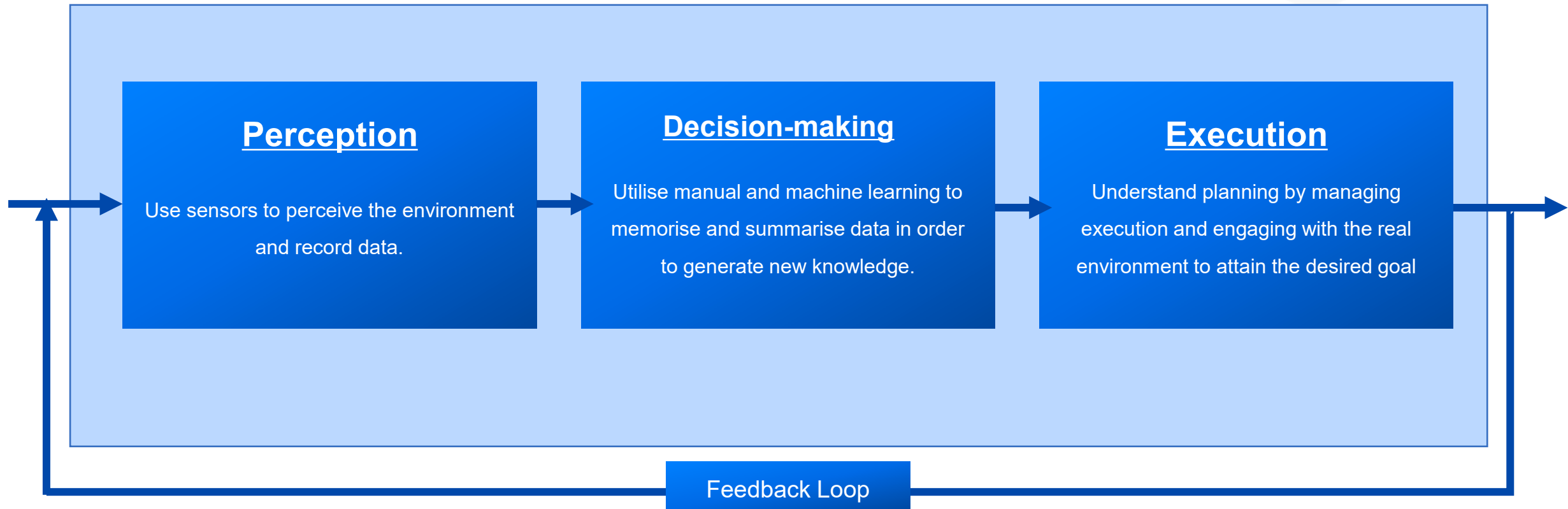
Achieve the Goal

VariFlight

Digitalization + AI Agent

AI Agent Technical Principles

AI is fundamentally the capacity to acquire and utilize knowledge in order to achieve objectives.



Professional Capacity Building of AI in Civil Aviation

Agent Application

Delivers aviation-focused user experiences by plugging domain-enhanced AI into real-world workflows.

03

Agent Application

02

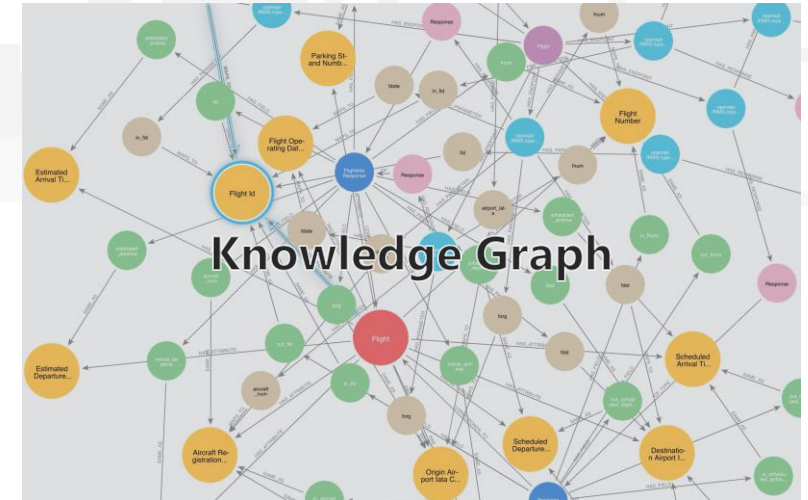
Domain Enhancement

01

AI Infrastructure

Domain Enhancement

Provides civil-aviation glossaries, ontologies, and rule-based knowledge graphs that inject authoritative industry context into the model.



Knowledge Graph

AI Infrastructure

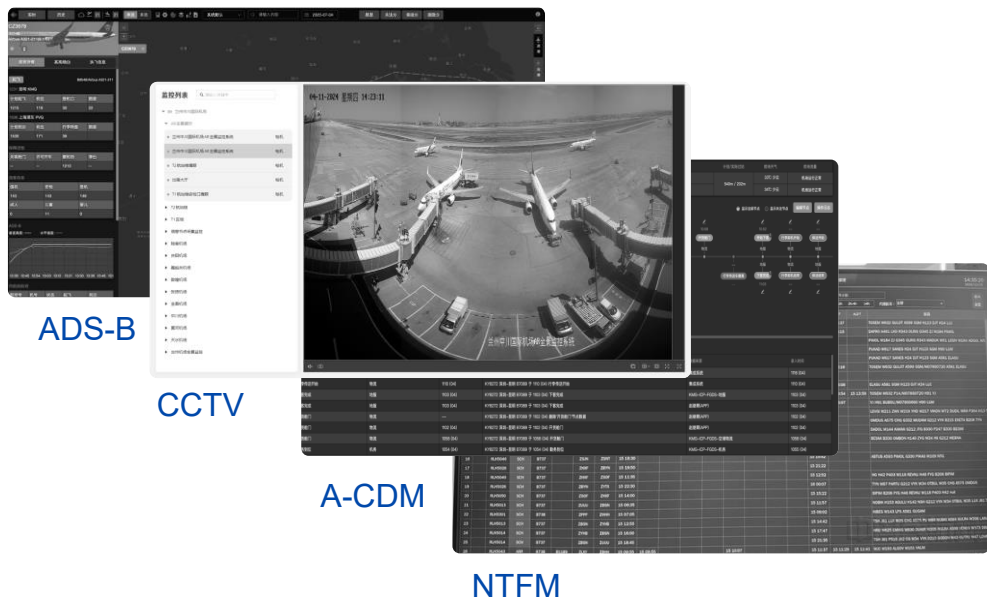
Provides the core offline LLMs, data pipelines, and compute that power large-scale reasoning and generation.

word	description
Flight	A flight refers to the operation of a...
Departure Airport IATA...	The three-letter IATA code that uniqu...
Flight Information	Flight Information refers to the comp...
Flight Date	The specific calendar date on which a...
Arrival Airport IATA C...	The three-letter IATA code that uniqu...
Airport	A ground facility for the operation with facilities...
Flight Number	A unique alphanumeric code assigned t...
Flight ID	A Flight ID is a unique internal iden...
Stand Number	A Stand Number is a unique identifier...
Aircraft Registration ...	A unique alphanumeric code assigned t...
Stand	A designated parking position at an a...
Aircraft	A machine capable of atmospheric flight,

Glossary

TAM-RM Agent

VariFlight



TAM-RM Agent

机位分配 靠桥率: 80% 周转频次: 80% 30分内变更率: 当前80% 平均滑行: 10m

未分配 00 未发布 00 要客 00 前站起飞 00 本场保障 00 告警 00

2022-1-1 发布 回滚 自动分配 日志

AI调整
全部 00
冲突处理 00
优化调整 00
待处理 01

冲突处理 占用冲突 2025-2-10 14:30:00 处置过程

1.数据监测: [113] 机位冲突: 进港 ZH8149 预计 15:32 (06) 到达本场, 当前在保障的航班 MU2257 预计起飞时间为 15:43 (06)

2.调整逻辑: - ZH8149 过站时间 60 分钟, 优先考虑减少旅客步行距离, 需变更至更合适的登机口。
- 如果需要修改 MU2257, 则在保证旅客登机便利的基础上择优分配。

3.重新计算 调整至 [000] 机位 (此处机位调配评分100) 与远机位同指, 变更登机口步行约 1 分钟。

航班ZH8149预计15:32(06)到达本场, 【113】号机位目前正在保障的航班 MU2257预计起飞时间为15:43(06)

自动处理: MU2257调整至 [000]

冲突处理 推出冲突 2025-2-10 14:30:00 处置过程

航班MU0000、MU0001存在推出冲突, 预计推出相差00分

自动处理: MU2257调整至 [000]

冲突处理 连续进港冲突 2025-2-10 14:30:00 处置过程

航班MU0000、MU0001到达时间相差00分钟, 占用同一机位

自动处理: MU0000调整至 [000]

优化调整 提升靠桥 2025-2-10 14:30:00 处置过程

1.数据监测: [112] 廊桥位空闲: 廊桥位 [112] 0000-0000空闲

2.调整逻辑: CA8603/4、CA8603/4、CA8603/4预计在该时间段过站, 目前分配在远机位

3.重新计算 CA8603/4、CA8603/4、CA8603/4调整至 [112] 可提升靠桥率

廊桥位 [112] 0000-0000空闲, 以下航班可选择变更至廊桥位

CA8603/4 CA8603/4 CA8603/4 CA8603/4 CA8603/4 确认 忽略

优化调整 进港延误 2025-2-10 14:30:00 处置过程

航班XX0000计划起飞0000, 由于前站保障至少还须00分, 无法准点起飞

自动处理: XX0000调整至待分配

优化调整 提升靠桥 2025-2-10 14:30:00 处置过程

廊桥位 [112] 0000-0000空闲, 以下航班可选择变更至廊桥位

CA8603/4 CA8603/4 CA8603/4 CA8603/4 CA8603/4

Agent	RM
Digitalization	ADSB、场监雷达、车辆定位、VAS航空器保障进程、GMAN任务、AMAP路径、EFPS

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TAM - RIPAS

Runway Incursion Prevention and Alerting Systems

The screenshot displays the TAM - RIPAS interface. At the top, a runway layout is shown with a red runway labeled '13' and 'CDC8812 落地'. The runway is flanked by taxiways and aprons labeled A1 through A7 and B3 through B8. A video feed in the bottom center shows an aircraft on the runway at night. To the right, a zoomed-in view of a taxiway shows a red '31' and a signal light with green, red, and white lights. The bottom left features a table of operations.

Lawn Mowing Operations 0935 - 0942	RWY 21 -> 03	2Car	8分	Approved
	03 21		01:56:42	Waiting to Start
Runway Surface Inspection 0535 (+1) - 0542 (+1)	RWY 21 -> 03	1Car	5M	Approval Denied
	03 21		--	Approval Denied
Runway Surface Inspection 0535 (+1) - 0542 (+1)	RWY 21 -> 03	1Car	5M	Working
	03 21		remaining time 03: 31	Exit



4 Company Overview

About VariFlight

VariFlight, a global leading Aviation Data intelligence company

VariFlight has spearheaded the realization of flight data transparency

Covered over **94%** of the global commercial flight data

Trusted by over **300 million** travellers and thousands of class-leading businesses around the world

Member of

Civil Air Navigation Services Organization (CANSO)

Airports Council International (ACI)

China Air Transport Association (CATA)

China Civil Airports Association (CCAA)

Observer of

International Civil Aviation Organization (ICAO)

VariFlight



Dual Headquarters & One Global Mission



Our Achievements

1,000+
30+

Global Customers

1,000+ partners from more than 30 countries & regions

20+

Profound Experience

20+ years in Civil Aviation

400+

A Professional Team

A team of over 400 professionals providing 24/7 services

**1.5
Billion**

Advanced Data Centre

VariFlight Data Center processing 1.5 billion pieces of raw data each day (time, status, gate, belt, position, schedule, stand, aircraft, engine, etc.)

1,200+
10,000+

Unrivaled Data Coverage

Data covering 1,279 airlines and 10,968 airports

170,000+

Flight Tracking

ADS-B system monitors over 170,000 flights daily

Our Milestones

VariFlight



2005
Founded

2011
VariFlight App released

2013
Our first 10 million App users

2014
Launched the first A-CDM system for Kunming Chang Shui Airport

2015
Started aviation data services for businesses

2017
180 million app downloads
A-CDM installed in 81 airports

2018
Co-authored the CAAC A-CDM Standards.

2024
Shared VariFlight TAM framework at ICAO

2025-2026
Support CAAC to establish TAM standards & to develop a TAM model at PVG

Legends:
TAM: Total Airport Management; **CAAC:** Civil Aviation Authority of China; **A-CDM:** Airport Collaborative Decision Making; **PVG:** Shanghai Pudong International Airport

Excellent R&D Capabilities

- 2019 World Manufacturing Conference (WMC) **Innovative Product Gold Award**
- **CMMI 5** certification for integrated maturity model capability
- **ISO27001** (safety system certification), **ISO37001** (anti-bribery management certification)
- **ISO9001** (Quality Management System Certification), **ISO20000** (Information Technology Service Management), **ISO14001** (Environmental Management System Certification)
- VariFlight's Trusted Civil Aviation Data Space Connector (**TCADSC**) has been certified by the International Data Spaces Association (**IDSA**).
- Partnership with research centers and renowned university like **Tsinghua University, National University of Singapore**

Our Global Partners



Our innovative aviation data and technology services are trusted by players within the aviation industry, and beyond.

Supporting ICAO Standards Formulation

VariFlight showcases Total Airport Management Solution at the 42nd ICAO assembly and innovation fair.



Future

TAM

Digitalization + SWIM/DS + Agents

VariFlight[®]