ICAO

中国民用航空局
空中交通管理局
Air Traffic Management Bureau. CAAC

Research and Realization of Continuous Operation and Emergency Response of ATMAS

Presented by China

Part1: Background

Part2: Our doing

Part3: Challenge

Part4: Solution & Outlook

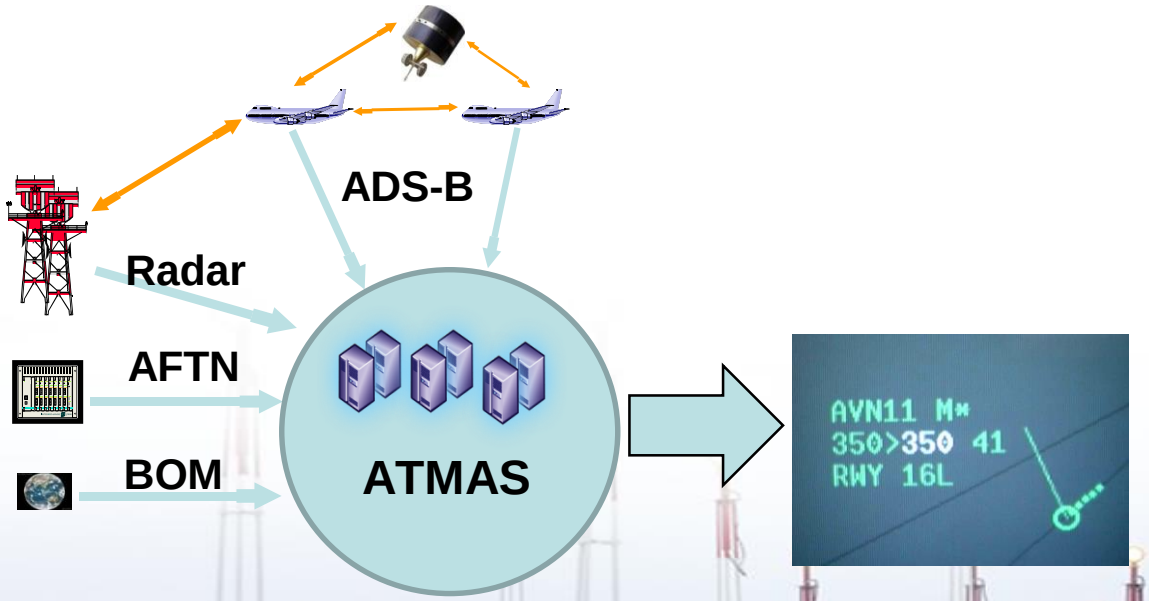
Part1: Background

Part2: Our doing

Part3: Challenge

Part4: Solution & Outlook

What's is ATMAS



ATM Automation System:

◆Core system of ATC operation

◆Maintain continuous operation in emergencies

◆ "Regional ATM Contingency Plan" and "Asia Pacific Seamless ANS Plan".

◆The main concern of each stage, and its solution

- construction
- operation
- future

Airspace & Control Area

FIR	11
Sum of Control Airspace	10.81 MKm²
Upper Control Area	15
Middle/Low Control Area	24
APP Control Area	46
Terminal Control Area	2
large-scale ATC control Center	8

ATMAS Deploy Status

- Due to the localized, distributed, minimum requirement based, maximum economical concerned principle and approach
- 6 vendors, 87 set ATM automation systems

Part1: Background

Part2: Our doing

Part3: Challenge

Part4: Solution & Outlook

Nowdays Soulution

Construction stage:

ATMAS

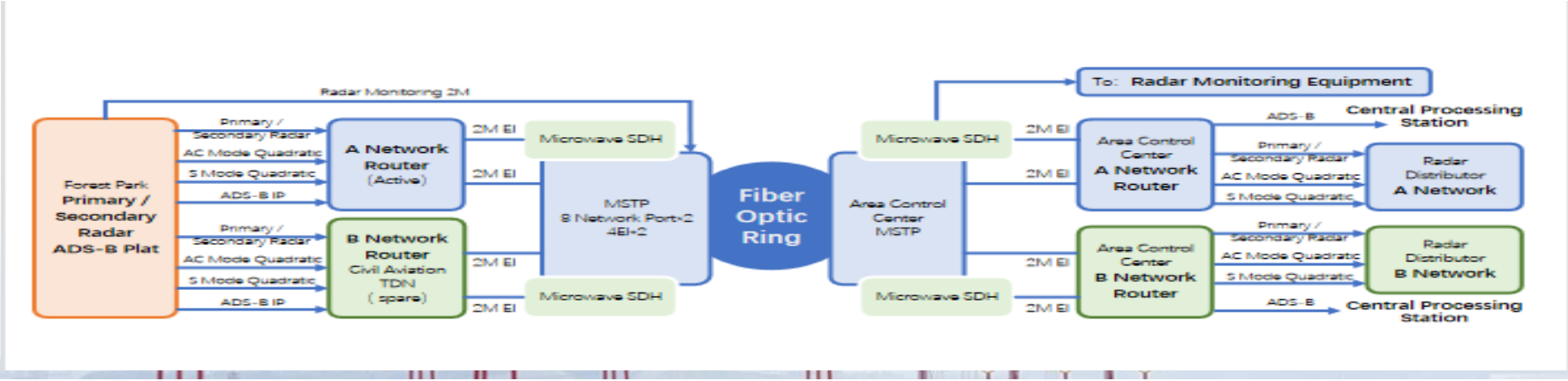
- Different manufacturers for the M/B systems
- Support the working mode of no less than three network operation;
- Full function of main and backup processing capabilities;
- Redundant data access (e.g., radar and ADS-B);
- Independent surveillance data bypass processor and other processors use a fully redundant distributed structure and with dual redundant hot-swappable power supplies.
- The terminal equipment, switching equipment, and transmission equipment are all configured with dual power supplies.

Nowdays Soulution

Construction stage:

Data Access:

- The system has dual redundant input of surveillance data and flight plan data， and same applies to other data inputs.
- Data input supporting equipment includes: signal active distributor, information protocol converter,etc., which also needs double redundancy configuration.



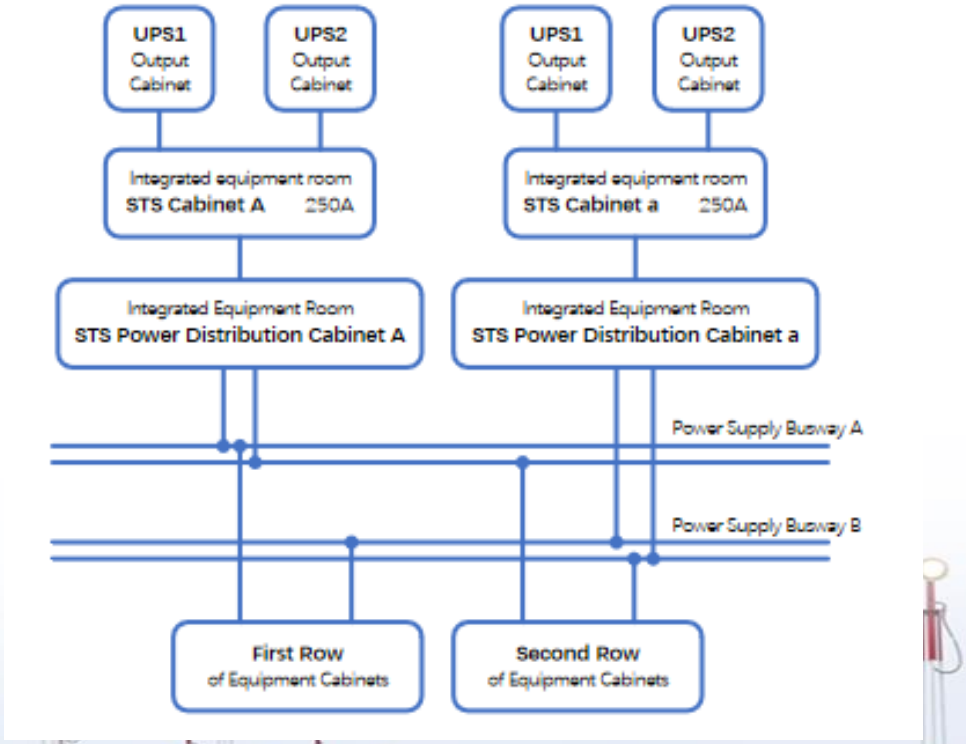
Nowdays Soulution

Construction stage:

Power Supply:

- The system is configured with two (1+1) redundant UPS systems and two STS static switching systems.

- The two sets of UPS output cabinets respectively lead one power line to the input end of the two STS devices, and connect one power line from the output end of the two STS devices to each device cabinet.



Nowdays solution

Operation stage:

- Enhance software version and requirement management:
  - Do best effort to keep the consistency of major ATM Auto system.
  - Unified requirements specification and Limited upgrade and modification to adopt new function requirement (such as processing the ADS-B and Mode-S data,Integrating AMAN,and coordinating with A-SMGCS, ATFM)

- Realize data synchronization between main and backup ATMAS:
  - Improve data synchronization between main and backup ATMAS
  - Improve the utilization of backup ATM Automation system and enhance the overall reliability and performance.

Nowdays solution

Operation stage:

➢ATMB has formulated and released the MH/T4029.3 data interface standard to stipulate the requirements for flight data exchange between ATMAS and related systems

- •Standardize ATMAS and related system interconnection interfaces
- •Improve data synchronization between main and backup ATMAS
- •Solve the problem of screen handover between ATMAS in different ATC Units
- •Suitable for flight plan and operational environment data interaction among various systems

ATMAS

ATMAS & iTWR

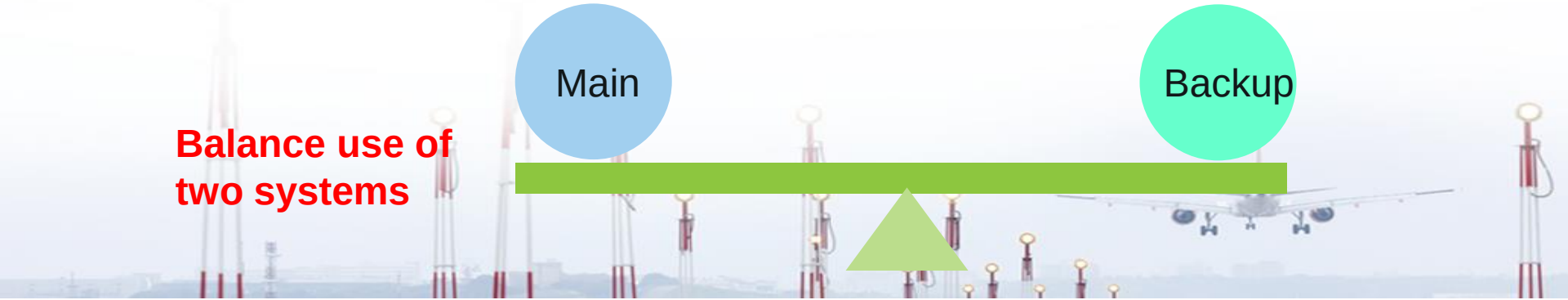
ATMAS & Flight Plan Processing System

Nowdays solution

Operation stage:

➢ATMB has put forward policy and management to require for the normal use of backup systems,proceed gradually in following three stages:

- Require all ATCUs to achieve 24-hour continuous use of backup systems during busy periods
- Required at least to be used continuously for 7 days per month
- From the "main-backup" mode to the "dual-main" mode



Nowdays solution

Operation stage:

Sites	Progress
Chengdu 、 Chongqing、Kunming、Quiyang、Hangzhou、Wenzhou ATCUs	Complete the balance use of the M/B systems within a single month, realizing the "dual-main" mode
Hangzhou, Wenzhou, Fuzhou, Qingdao, Wuhan, Zhuhai, Shenzhen, Haikou, Chengdu, Chongqing, Kunming, Xi'an, Urumqi ATCUs, etc.	The backup system can be used continuously for 7 days in a single month
Beijing、 Shanghai and Guangzhou ATCUs	The backup system can be used continuously for 24 hours during busy periods
Still a few ATCUs	Only use the backup system at night

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Change and Growth

Year 2000

Beijing ACC	Shanghai ACC	Guangzhou ACC
0.25M	0.41M	0.38M

Original performance goal of Automation system:

RDP for 16 Radars ,FDP for 3000 messages and Max HMI for 26

Year 2019

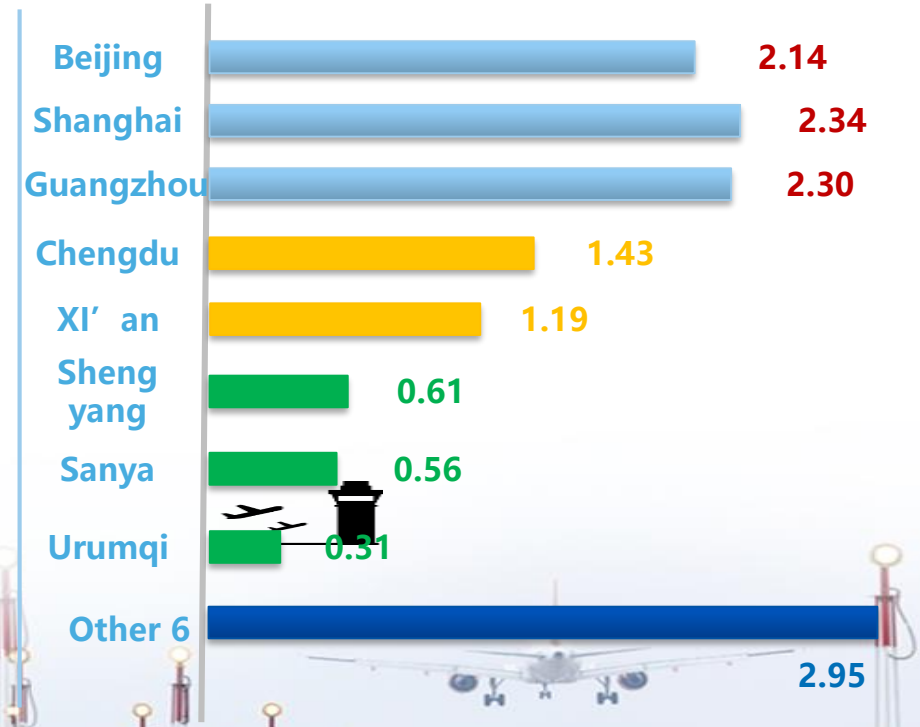
Beijing ACC	Shanghai ACC	Guangzhou ACC
2.14M	2.34M	2.30M

After upgrading, current performance:

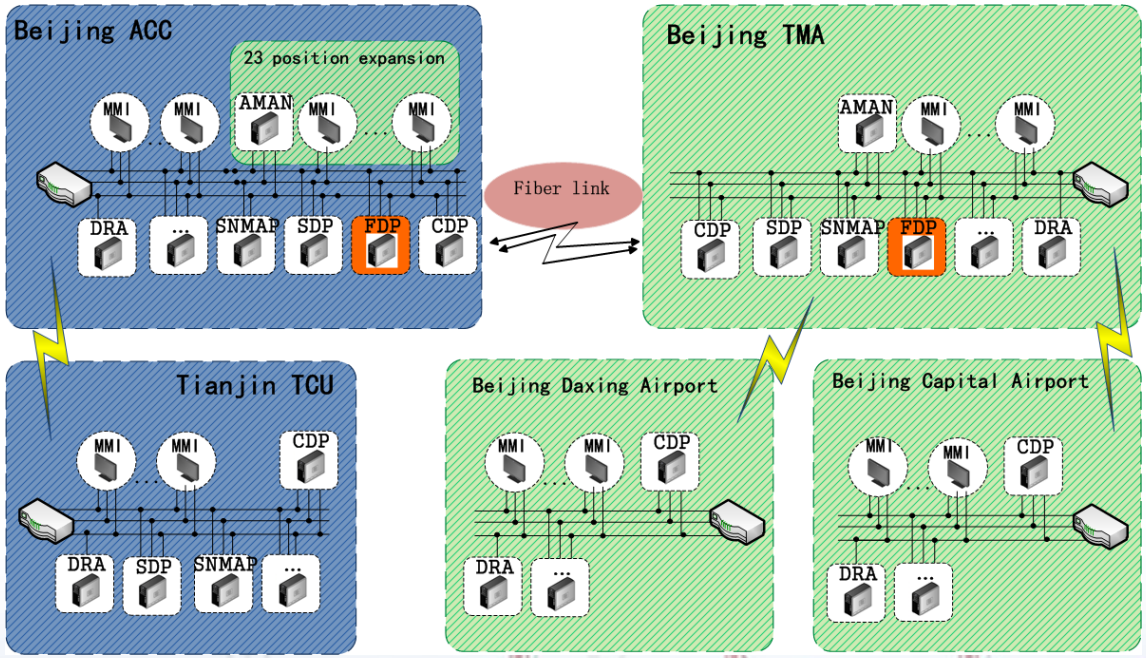
RDP for 32 Radars , FDP for 20000 messages,and Max HMI for 400

Upper Control Area：15
Total Volume of Flights：15M

Year 2019 : Volume of Flights（M）



The Largest ATMAS



Beijing ATM Automation System, the largest system in the world.

◆ Meeting the requirement of heavy traffic flow of two hub airports in Beijing and Tianjin Binhai International Airport.

◆Provision ATM services for two cities, three airports, and five facilities.

◆There are 230 MMIs, 360 nodes.

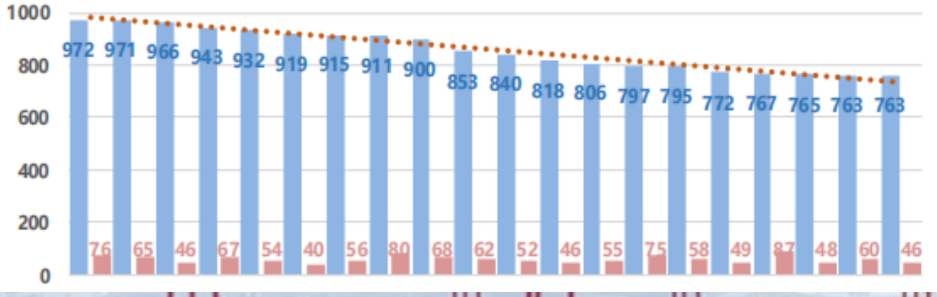
◆ Five sub-system **share flight data through the central Flight Data Processor.**

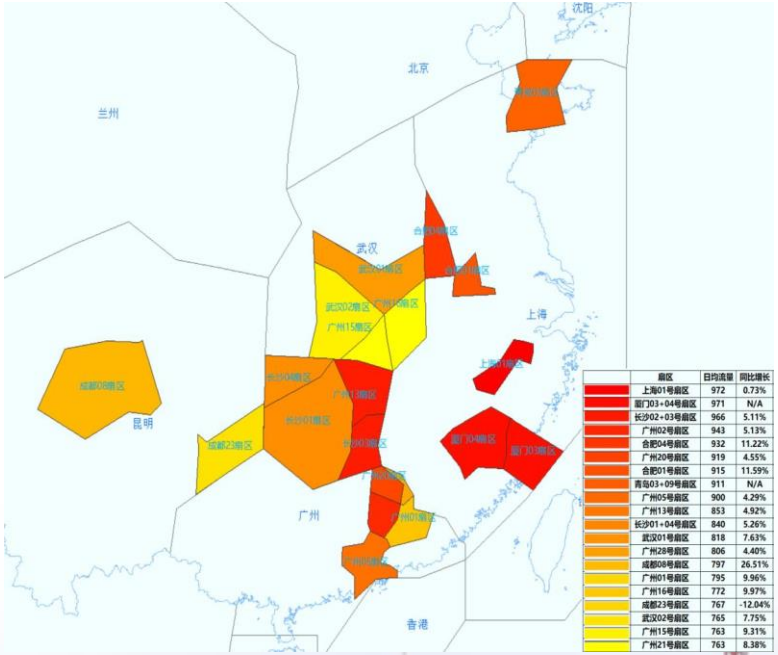
Congestion and unbalance of airspace

About 90% of the busiest sectors have peak hour traffic volume beyond the threshold

The highest average daily volume is 972, achieved in Sector 01 of Shanghai ACC

The highest peak hour volume is 87，achieved in sector 23 in Chengdu ACC



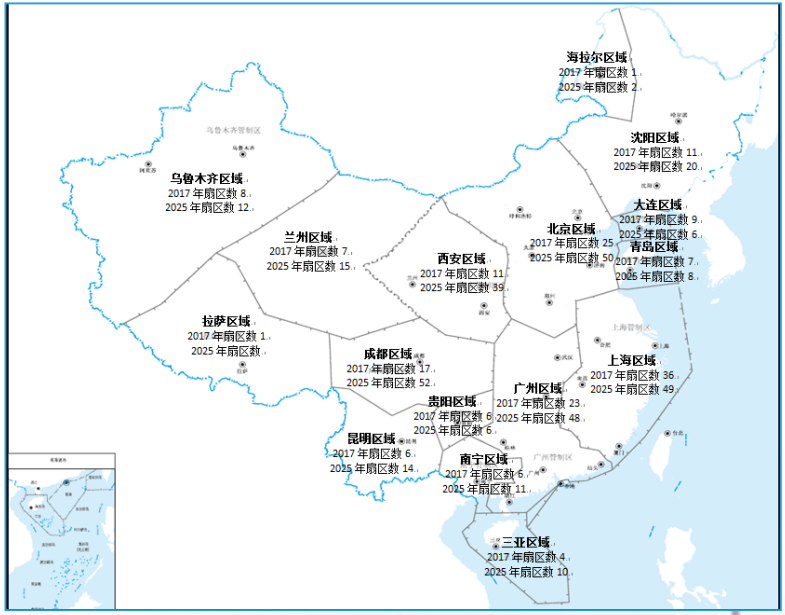


	扇区	日均流量	同比增长
	上海01号扇区	972	0.73%
	厦门03+04号扇区	971	N/A
	长沙02+03号扇区	966	5.11%
	广州02号扇区	943	5.13%
	合肥04号扇区	932	11.22%
	广州20号扇区	919	4.55%
	合肥01号扇区	915	11.59%
	青岛03+09号扇区	911	N/A
	广州05号扇区	900	4.29%
	广州13号扇区	853	4.92%
	长沙01+04号扇区	840	5.26%
	武汉01号扇区	818	7.63%
	广州28号扇区	806	4.40%
	成都08号扇区	797	26.51%
	广州01号扇区	795	9.96%
	广州16号扇区	772	9.97%
	成都23号扇区	767	-12.04%
	武汉02号扇区	765	7.75%
	广州15号扇区	763	9.31%
	广州21号扇区	763	8.38%

The busiest 20 sectors in 2022

Airspace requirement prediction

	2017	2025	2035
All Sectors	360	752	
EnRoute Sectors	223	439	620
Approach Sectors	137	313	



Larger scale ATM Auto system or more ATM Auto system

Part1: Background

Part2: Our doing

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long-term solution for future

Construction stage:

- **Adopt Top-down approach to develop and deploy next generation ATM Auto system uniformly**
  - Determine the number and scale based on the prediction of national wide Air Transportation growth and ATC service requirement
  - Develop the technical specification with detailed function and performance requirement
  - Develop the prototype system for evaluation, verification and optimization
  - Frozen the technical specification and function requirement
  - Purchase and deploy the new ATM Auto system nation widely or regionally

The Next Generation ATM Auto system should be customized, relative unified system supporting seamless ATM services

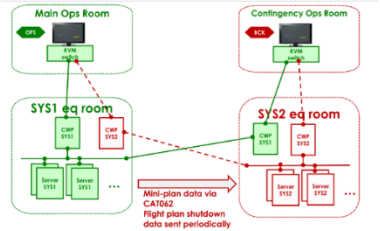
Research the ACC disaster recovery operation mode:

- **the Definition of the ACC Disaster Recovery**
  - ✓The ATC services of the ACC are interrupted due to disaster and can not be continued in a period of time, including high-intensity earthquakes, major fires, explosions, and the overall breakdown of key systems such as the power supply ,and ground-air communication sysytem.

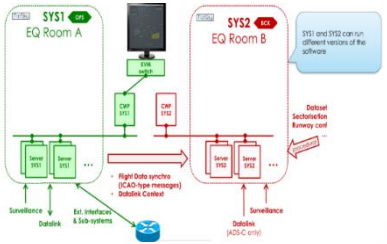
- **the ACC Disaster Recovery Operation Mode**
  - ✓The Second ACC Hall (same city and same site, or different site)
  - ✓Upper Air takeover by adjacent ATCUs ACC

Long-term solution for further

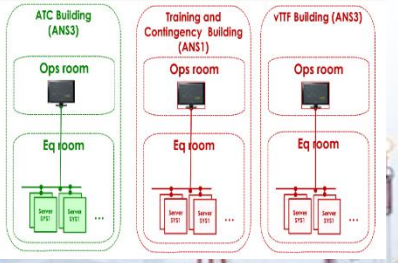
Global Deployment



Hong Kong, China



Singapore



Budapest

long-term solution for future

ACC Dual Center
(Main+Sub building)

1

ACC Control Service

2

Multifunctional center

3

Emergency Response

Test Training Mode

Control Mode

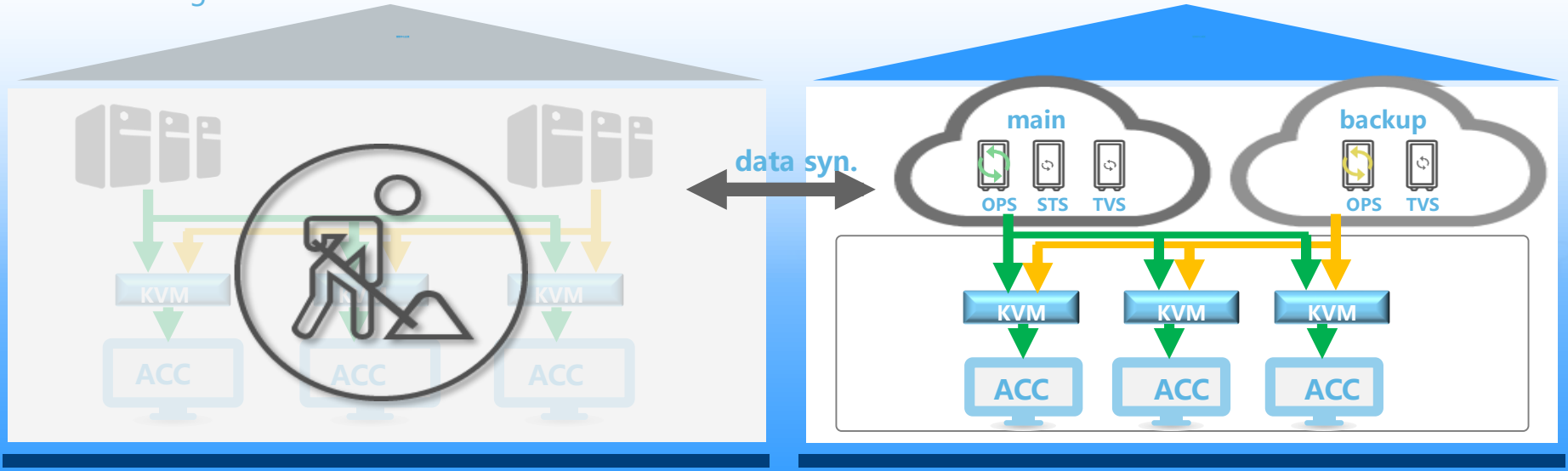
Long-term solution for further

Emergency level	Scene	Main Building (ACC)	Subbuilding (ACC)	Notes
Standby	**Regular**	Main ATMAS Operation	Testing and Training	Real time reception of ATMAS data synchronization from the Main to Sub building
IV Blue	Main ATMAS malfunction, upgrade or maintenance ;	Buckup ATMAS Operation	Testing and Training	Real time reception of ATMAS data synchronization from the Main to Sub building
III Yellow	the ACC main building malfunction, maintenance, renovation	Control service suspension	ATMAS Operation Control service , Testing and Training suspension	
II Orange	The TMA 、APP are unable to provide Control Service	Continue regional control services while taking over affected terminal/approach control with a standby seat	Testing and Training	Short-term takeover
		Continuation of regional control services	Take over affected terminal/ approach control services. Options：Testing and Training	Medium and long term takeover，
I Red	Control Services are not available at adjacent ACC	Continuation of regional control services	Continue regional control services while taking over affected terminal/approach control with a standby seat Options：Testing and Training	

Emergency Takeover Oeration Scenario

Level III Emergency Operation Scenario - Sub Building takes over the Main Building

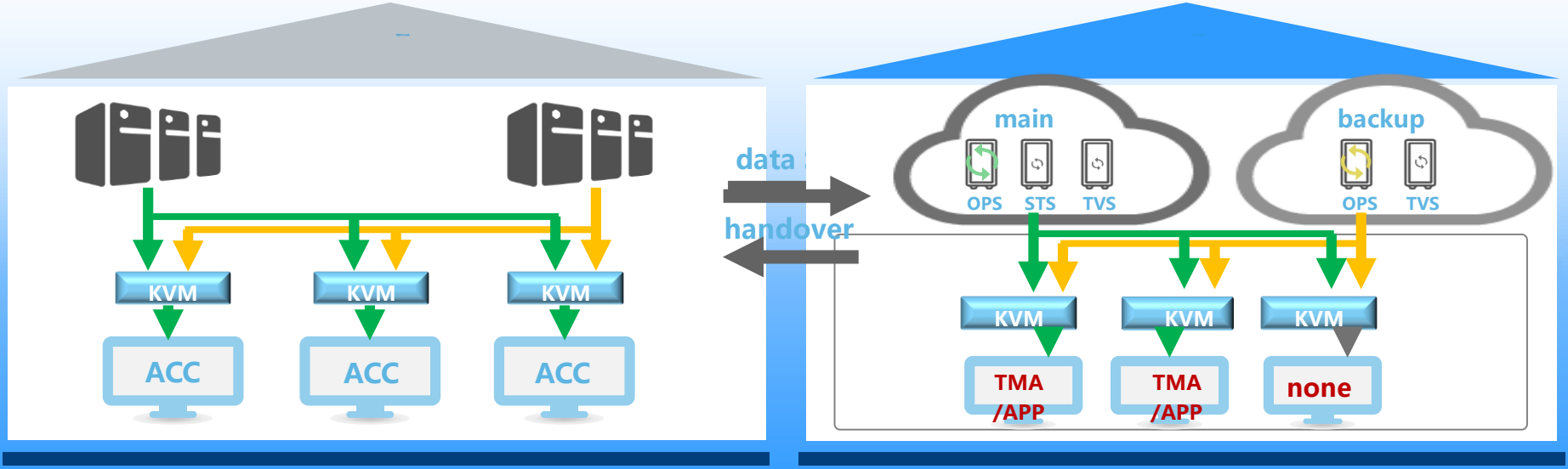
- ACC Main Building out of service.
- ACC Sub Building signal connection, seat client host and other equipment start work, undertake control services of the main building of the control center. The main and backup systems in the sub building of the ACC center synchronize data in real time.
- The ACC center sub building outputs integrated track and flight plan data in real time to the ACC center main building.



Emergency Takeover Oeration Scenario

Level II Emergency Operation Scenario - Sub Building takes over the TMA or APP

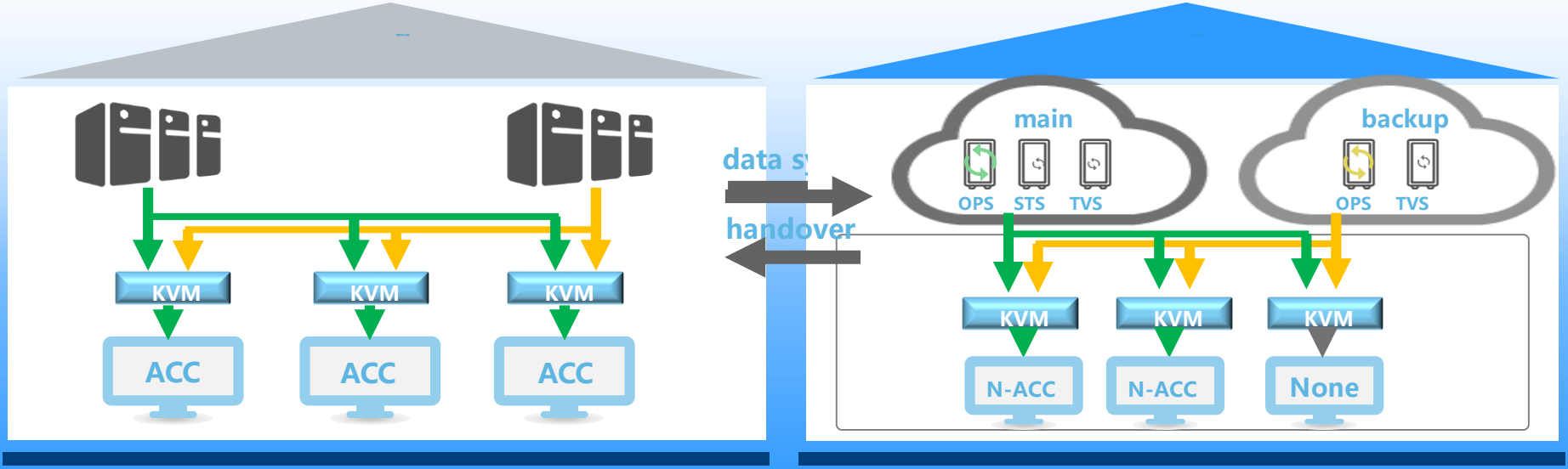
- The main building of the ACC center undertakes ACC control services in the region, and real-time data synchronization is carried out between the main and backup systems of the main building .
- The ACC Centre sub building is responsible for the normal control services of the corresponding approach (terminal) control area.



Emergency Takeover Oeration Scenario

Level I Emergency Operation Scenario - Sub Building takes over the adjecent ACC

- Responsible for the normal regional control services in the area, real-time data synchronization between the main and backup systems in the main building to ensure the continuity of the control services in the center.
- The ACC center sub building provides regional control services for the neighboring ACC, and suspends training and testing services.
- The main and backup data are not synchronized in the main and sub buildings of the ACC center, but MH/T 4029.3 C and AIDC data need to be transferred.



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THE END THANKS!