



ICAO

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**Third Meeting of the Asia/Pacific Air Traffic
Management Automation System Task Force (APAC
ATMAS TF/3)**

Video Tele-Conference, 8– 10 June 2022

Agenda Item 4: ATM Automation System Implementation by States

4.3 Development of new technology

NEW TRENDS OF THE CONTROLLER TRAINING SYSTEM DEVELOPMENT

(Present by China)

SUMMARY

This paper presents the novel trends of controller training system development in circumstance of surging new technological application.

1 INTRODUCTION

Controller Training

1.1 Controller training normally consists of two parts: first replaying and reviewing airspace situations, and second exercising on the controller training system. The airspace situation data for replaying is normally exported from the ATM automatic system.

1.2 Now there still exist some hurdles in the controller training.

➤ The gap between reality and training script: unrealistic airspace situation and conflict, insufficient flight numbers, sluggish in script update and lack in assessment standard.

➤ Data export from operating ATM automatic system could cause system breakdown in extreme and rare situations. And replaying on ATM automatic system may also cause system failure.

➤ Segregation between TOWER-controller and ACC/TMA-controller training system.

➤ Human resource inefficiency: certain staff playing the pilot role while exercising on the controller training system.

New Technological Application:

1.3 **Virtual Machine:** improving system efficiency, enlarging system volume and reducing hardware.

1.4 **Voice recognition and artificial intelligence:** recognition of controller's voice and transformation of voice instruction into machine instruction.

2 SYSTEM DESIGN

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2.1 A novel controller training system should utilize virtual machine technology and be equipped with new features as below.

2.2 Controller training system can import airspace situation from ATM automatic system, extract flight information (plan and radar) and generate exercise script.

2.3 Controller training system can be used as a platform for airspace situation replay, using data from air traffic automatic system.

2.4 TOWER-controller and ACC/TMA-controller training system can perform joint exercises based on a shared script.

3 TECHNOLOGICAL SOLUTION

3.1 The novel system is a platform, utilizing RedHat KVM to realize system virtualization, fully exerting the surplus performance of equipment, and allocating balanced resources including disk space, memory, CPU, network, etc. Multiple systems, such as controller training system and airspace situation replaying system, can be virtualized in one platform.

3.2 The operators can switch among the virtualized systems and perform multiple tasks simultaneously. And technological maintenance, backup and recovery can be more convenient than before.

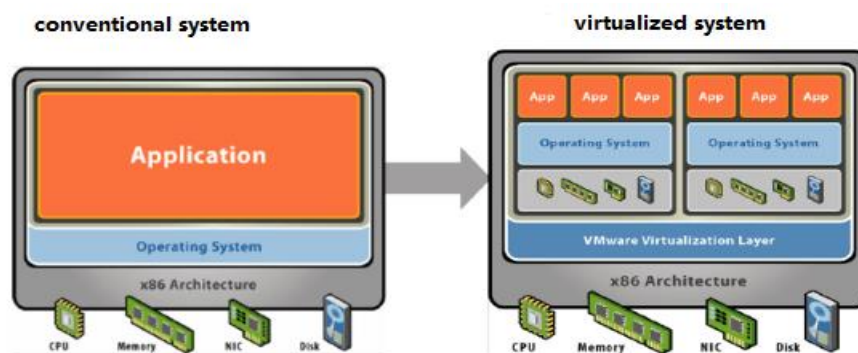


Figure 1 Virtual Machine Structure

3.3 By comparison, it can find that the demand for hardware equipment such as servers, workstations and switches in the conventional training system with a scale of 5 positions is about 26, while the demand in the virtual training system is only 9, which can be imagined as a significant fall in investment. This clearly shows that virtualization is more efficient and economical.

Training script creation on the platform

3.4 ATM automatic system records all the replaying data in its specific server, usually named Rec. The Rec server collects surveillance, plan, warning, and operation data from all servers and controller positions. The default duration is set at 30 days.

3.5 A specific tool, script generator, in the controller training system is needed to create scripts for controller training. The generator can extract data from Rec, including flight plan, controlling sector, time information, etc. The reality of the airspace situation can be embodied in the scripts.

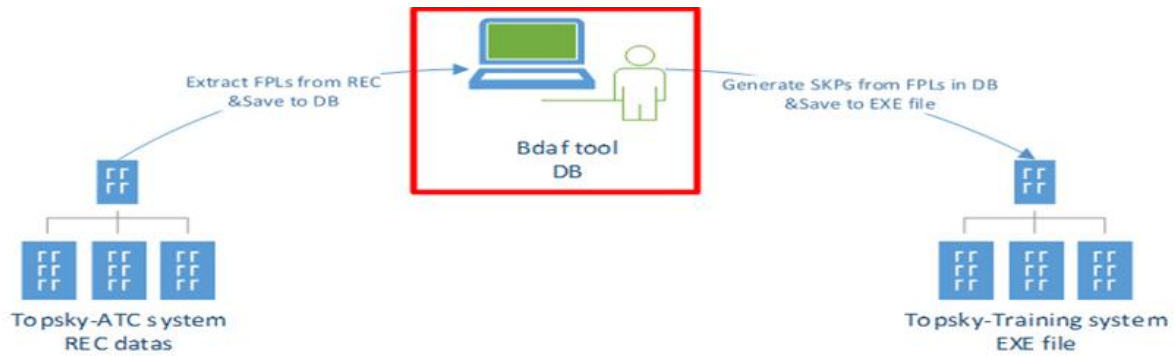


Figure 2 Platform Structure

3.6 As the script generator extracts the flight plan, the tool compares sector and time appointed by users with the flight plan information which contains actual time over a specific route point. After comparison, a scripted kinematic flight plan is initiated with reasonable elements, position height and actual arrival time to a sector boundary.

3.7 The scripted plan complies to the extracted plan with all the route point information in the appointed sector. And one more point through which flight enter and exit the sector need to be saved. As initiated, the scripted plan is ready for controller training.

No	Callsign	AAT	ETD	EET	RQS FL	FL	CFL	TAS	ACTYPE	ADEP	ADES	SSRA	SSRB	Pilot	EST
001	CXA8172	0118	0004	0200	S0951	S0146	S0948	K0703	B738/M	ZBAA	ZSFZ	0001	0001	01	0000
002	CSN6404	0105	0040	0200	S1009	S0948	S0948	K0703	A320/M	ZUCC	ZYTX	0073	0073	02	0000
003	CES2073	0119	0001	0200	S0750	S0146	S0750	K0703	B737/M	ZBAA	ZSLY	0072	0072	01	0000
004	CHH7708	0047	0122	0200	S1131	S1131	S0065	K0703	A320/M	ZGSZ	ZBAA	0066	0066	02	0000
005	CSC8371	0107	0057	0200	S1070	S1070	S1070	K0703	A320/M	ZUUU	ZYHB	0005	0005	01	0000
006	RLH6542	0057	0007	0200	S0920	S0469	S0920	K0703	B738/M	ZBDH	ZUUU	0047	0047	02	0000
007	CSZ9735	0103	0033	0200	S0981	S0981	S0887	K0703	A320/M	ZYTX	ZSOF	0101	0101	01	0000
008	CBJ5536	0113	0128	0200	S0981	S0981	S0981	K0703	A320/M	ZYTX	ZBSJ	0041	0041	02	0000
009	CHH7165	0110	0025	0200	S1039	S0991	S1039	K0703	B738/M	ZYTL	ZBYN	0051	0051	01	0000
010	CXA8106	0127	0001	0200	S0951	S0131	S0948	K0703	B752/M	ZBAA	ZSAM	0072	0072	02	0000
011	CSN3287	0106	0056	0200	S0890	S1006	S0056	K0703	B738/M	ZGKL	ZBAA	0041	0041	01	0000
012	HXA2911	0120	0005	0200	S0811	S0421	S0811	K0703	CRJ9/M	ZBZJ	ZYTL	0050	0050	02	0000
013	CESS194	0156	0003	0200	S0689	S0146	S0689	K0703	A321/M	ZBAA	ZSQD	0073	0073	01	0000
014	CSN6700	0112	0032	0200	S0719	S0719	S0719	K0703	B738/M	ZSYT	ZBYN	0030	0030	02	0000
015	TEST001	0000	0010	0100	S1000	S1000	S1000	K0000	A320/M	ZUUU	ZBAA	0032	0032	02	0000
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Figure 3 Scripted Kinematic Flight Plan table

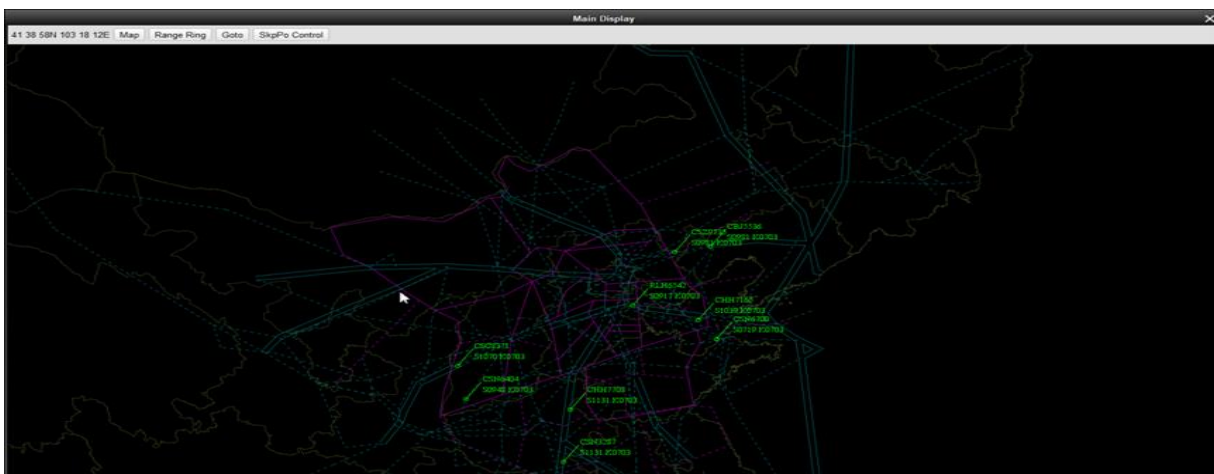


Figure 4 Controller Training System Human Machine Interface

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Replay on platform

3.8 In the virtualized platform, the airspace situation replaying system is integrated. So airspace review and replay can be implemented on virtualized platform instead of ATM automatic system, avoiding the risk of system failure. A NAS (network attached storage) center is deployed between the virtualized platform and the REC server. The replay data can be copied from Rec to NAS both in real-time or pre-scheduled. And virtualized platform export the data from NAS as needed. As the result, controllers can review and replay airspace data in the virtualized platform at the time they require. A firewall is installed to separate NAS and the virtualized platform for cyber security. And multiple types of Raid can be applied in NAS to secure data and prolong storage.

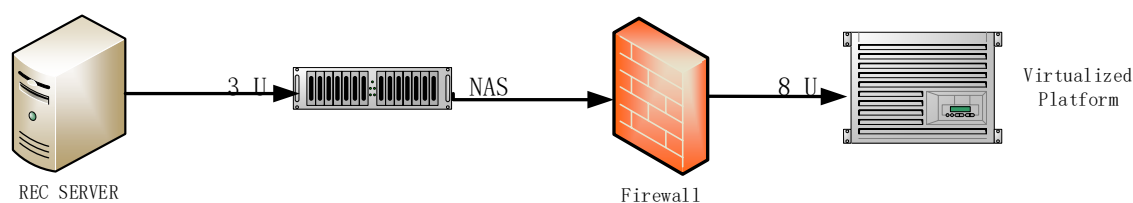


Figure 5 Structure for Replay Data Export

Joint training of TOWER-controller and ACC/TMA-controller training system

3.9 A joint training script needs to be created in both TOWER-controller and ACC/TMA-controller training system.

3.10 When the joint exercise is performed, data exchange between TOWER-controller and ACC/TMA-controller training system can be realized by specific protocol, such as MH/T 4029.3, which is compiled for synchronization between main and backup ATM automatic system by CAAC. Through data exchange, the flight plan is synchronized between TOWER-controller and ACC/TMA-controller training system. And flight transfer can be delivered by electronic strips. Particularly, complete route information for arrival and departure procedure should be included in the flight plan.

4 THE DEVELOPMENT TREND**Voice Recognition and Artificial Intelligence Application**

4.1 Virtualization can address the hurdles of hardware, investment and space efficiency. And rational and prudential data exchange can strengthen script generation, realize joint training and guarantee data security.

4.2 On the other hand, in terms of human resource efficiency, voice recognition and artificial intelligence can be introduced to play the role of a pilot in the training system. The new technology receives the controller's instruction, analyzes semantic meaning, clarifies intention and performs the controller's instruction. And pilot-repeating instruction is voiced to stimulate the situation-reality. Some voice databases need to be established to collect real controller instruction, and artificial intelligence can improve accuracy and spontaneity by real instruction data accumulation.

4.3 In addition, an AI-based automatic self-learning scoring module can be introduced to evaluate controller training of the controller, and give fair and reasonable suggestions.

4.4 ATMB has plans to apply voice recognition and artificial intelligence in the control training system.

5 ACTION BY THE MEETING

5.1 The meeting is invited to:

- a) note the information contained in this paper; and
- b) discuss any relevant matter as appropriate
