

Meeting on 15 December 2014

Information Paper

**Public Hearing on
Report No. 63 of the Director of Audit
Chapter 4 – Administration of the Air Traffic Control
and Related Services**

**By
Public Accounts Committee of the Legislative Council**

Replacement Air Traffic Control System of the CAD

Objectives

The Audit Commission has completed a value-for-money audit on administration of the air traffic control and related services. The management of the new Air Traffic Control (ATC) system project is mentioned in Chapter 4 of Report no. 63. This paper is intended to provide relevant information to the members of Public Accounts Committee of the Legislative Council on the Replacement of ATC System of the Civil Aviation Department (CAD).

Background

2. In order to enhance the handling capacity of air traffic control with a view to supporting the growth in air traffic at the Hong Kong International Airport, the CAD obtained funding of \$1.56 billion from the Finance Committee of the Legislative Council in May 2007 for replacing its existing ATC system. In 2007, the CAD obtained endorsement and funding from the Finance Committee to create a new post of Assistant Director-General of Civil Aviation (ATC Project) (the post was deleted in 2013) responsible for leading a project team to oversee and coordinate the new ATC system project, including the Replacement ATC System and construction of a new CAD headquarters.

3. The CAD has strictly followed the rules and procedures as stipulated in the Government Stores and Procurement Regulations (SPR) and the World Trade Organisation Government Procurement Agreement (WTO GPA) throughout the procurement of the new ATC system. Tendering exercise was commenced in 2009, and the relevant contracts were awarded by 2012 or earlier.

4. The Hong Kong Special Administrative Region Government has always place utmost importance on aviation

safety. Before commissioning the new ATC system, the CAD must be satisfied with a safe, reliable and stable operation of the new system, fulfilling the stringent international ATC requirements.

Tender documents of the new ATC systems

5. The tender documents for procurement of the new ATC system were developed by the CAD in accordance with the SPR. The tender documents stipulated the technical requirements for the new system, including a stable and reliable system architecture, enhanced flight information and data processing capability, highly automated with advanced safety net features, precise flight trajectory prediction function, etc. These requirements were formulated based on the latest technical, operational and safety standards adopted worldwide in regard to ATC system, as well as the experience in operating the existing ATC system. The objective is to enhance the processing capacity and functions of the new ATC system in compliance with the latest International Civil Aviation Organisation (ICAO) requirements. The tender documents were approved by the Government Central Tender Board (CTB) comprising representatives from the Financial Services and Treasury Bureau (FSTB) and the Government Logistics Department (GLD), etc.

6. Prior to developing the tender documents, the CAD had conducted comprehensive market research on ATC system, and paid fact-finding visits to overseas major ATC centres to exchange views with the air traffic control personnel there and learnt from their experience. The CAD could acquire more in-depth understanding on the latest technical, operational and safety standards adopted worldwide in operating ATC system, thereby facilitating the incorporation of latest technology and safety requirements into the tender documents.

7. The CAD consulted the aviation industry about its plan to replace the ATC system, including the International Air Transport Association, the Hong Kong Air Traffic Control Association, and the Panel on Economic Services of the Legislative Council. From 2007 onward, the CAD discussed and collected views of the air traffic control personnel in various areas, including new system project planning, system functions, human-machine interface, operation workflow, implementation and transition etc. This ensures the new ATC system to meet the operational needs and requirements by incorporating the collected views into the tender documents.

Functions of the New ATC System

8. After detailed study, the CAD decided to group the 18 ATC systems and facilities as proposed in the Funding Paper approved by the Finance Committee in May 2007 into 8 system projects, as follows :-

- (i) Air Traffic Management System (ATMS)
- (ii) Air Traffic Services Data Management System
- (iii) Aeronautical Information Management System
- (iv) Aeronautical Messaging System
- (v) Communication Backbone
- (vi) Communications and Recording System
- (vii) Relocation and Expansion of Air Traffic Services Message Handling System
- (viii) Ancillary and Technical Support Systems

The composition of system and facilities of the above 8 system projects is detailed in **Annex I**.

9. The CAD specified various technical requirements in the tender documents, including the new ATMS can handle 8,000 flight plans every day, and monitor 1,500 air or ground targets simultaneously, which is about 5 and 1.5 times of the existing system respectively.

10. In addition, the CAD also required the new ATMS to incorporate the state-of-the-art functions, including automatic display of important flight information, air traffic situation, optimised arrival sequence and landing time of flights etc. Such technology was crucial to sustaining the efficiency of air traffic services, and also beneficial to enhancing our compatibility with other ATC system in other regions, thereby satisfying the air traffic growth at the Hong Kong International Airport (HKIA).

The Status of Replacement ATC System

11. A comparison between the current implementation status of the new ATC system, and the schedule and project expenditure submitted to the Panel on Economic Services of the Legislative Council in February 2007, is given in **Annex II** and **Annex III** respectively.

12. 7 out of 8 system projects of the entire new ATC system (see para. 8(ii) to (viii)) have been substantially completed as scheduled. 2 of the system projects have been put into operational use since 2013. Another 5 system projects are planned for operation in phases commencing 2015. The CAD is making an all-out effort to work with the system contractor in testing the remaining ATMS (see para. 8(i)). According to the current testing and problem

***Note by Clerk, PAC:** Please see Appendix 9 of this Report for Annex III.

rectification progress, the entire new ATC system is expected to be available in 2015 for training air traffic control personnel. After completion of all the training (9 - 12 months) and confirming the new ATC system could fulfill all the safety requirements, it is planned to commission the New ATC Centre in the first half of 2016.

13. During the Factory Acceptance Test (FAT) of the new ATMS in June and July 2012, the CAD recorded about 200 deficiencies/observations items, while more than 90% of them have been rectified and verified in June 2013. In fact, those deficiencies/observations items identified by the CAD during the acceptance tests do not imply that the new ATMS is not functioning properly or it is unsafe. Given the stringent acceptance tests and the complexity of the new ATMS, it was unavoidable that some deficiencies/observations items were identified. The purpose of the test is to ensure that the ATMS manufactured by the large overseas manufacturers could adapt to the local Air Traffic Management environment, and the system could operate safely, stably and reliably. In fact, it is not uncommon to have deficiencies/observations items identified during acceptance test in ATC system replacement projects in other countries. Similar observations were also recorded during the testing of the existing ATC system prior to its implementation at the HKIA.

14. The CAD has been looking forward to early commissioning of the new ATC system. However, the ATMS of the new ATC system is a highly complicated and sophisticated system requiring longer time than expected for conducting different types of tests, including Factory Acceptance Test (FAT), Site Acceptance Test (SAT) and System Integration Test (SIT) etc., which caused delay to the entire Replacement ATC System project. Regarding the liability issues, the CAD will adopt a prudent approach and take appropriate action according to the relevant provisions of the contract. In addition, since aviation safety is the first priority of the CAD, we must ensure the safety, reliability and stability of the new system before putting them in operation. In regard to the time required for systems procurement and testing, we admit that our original schedule might be a bit too ambitious. According to the overseas experience, it normally takes approximately 6 years from contract award to completion for similar large-scale ATC system replacement. For instance, it took 6 years for Singapore to replace their ATC centre, with 3 years' delay incurred. Likewise, the Swanwick ATC centre in the UK, which is responsible for the southern airspace covering the Heathrow airport, took about 11 years to replace their ATC centre and suffered about 6 years' delay.

15. The CAD will continue to urge the contractor to expedite rectification of the outstanding problems in the new ATMS and closely monitor the remaining contract work to minimise further project delay.

Procurement of the new Air Traffic Control System

16. The evaluation of the tenders for the new ATC system was conducted strictly in accordance with the SPR and WTO GPA.

17. For the Air Traffic Management System (ATMS), the processes leading to contract award is described in **Annex IV**. According to the SPR, the CAD established a Tender Assessment Panel (TAP) with 11 experienced engineering and air traffic control personnel to evaluate the tender offers. The TAP was led by a Chief Electronics Engineer, with members consisting of 1 Senior Electronics Engineer, 3 Electronics Engineers, 1 Senior Evaluation Officer, 2 senior Air Traffic Control Officers, 2 Air Traffic Control Officers and one Technical Support Officer.

18. The TAP adopted a marking scheme as stipulated in the SPR to evaluate the tender offers. It consisted of two parts, namely the technical and price score. For the technical parts, the score is calculated according to the

technical requirements as stipulated in the tender document. Such evaluation criterion applied to all potential bidders and had been approved by Central Tender Board (CTB). All criteria were clearly stipulated in the tender document for reference by the potential bidders. To ensure the evaluation was conducted in a fair and impartial manner, the TAP firstly conducted technical assessment against each tender and calculated the technical score. After completion of the technical assessment, the GLD then provided the TAP with the price information of the tenders to calculate the price score. In some cases, after receiving the bids and during the tender assessment process and in accordance with the tender provisions, the CAD might conduct assessment by visiting the factories of bidders who have fulfilled the basic qualification.

19. After completion of the tender evaluation by the TAP, the tender with the highest score would be recommended for consideration and approval by the Government Central Tender Board, which was chaired by the Permanent Secretary for Financial Services and the Treasury, and comprised representatives from the FSTB and GLD. Since the tender proposal of the Autotrac3 system offered by the Raytheon Company obtained the highest overall score, the contract for the ATMS was awarded to the Raytheon Company. The contract was signed between the GLD and the Raytheon Company in early 2011.

Contract variation of the new ATMS

20. After detailed study, the CAD proposed contract variations in 2012 and 2013 respectively to enhance the ATMS under the new ATC system. The enhancements include strengthening the air traffic flow management and relevant functions of human-machine interface, adding training positions in the Simulator System, etc. All contract variations arising from the enhancement work were conducted in accordance with the SPR with detailed breakdown of the enhancement items and costs, and had been vetted and approved by the GLD. The total cost for the Replacement ATC system project, including the two contract variations on ATMS, does not exceed the limit of the approved budget.

21. The reason for contract variation in 2012 was that after the ATMS contract was awarded, the CAD considered that there was still room to incorporate more advanced and updated functions into the system in order to cope with the latest requirements for ATC operation at the HKIA (including the ever evolving arrival sequencing requirement), and to match up the continuous enhancement of international air traffic management standards. Certainly, it would have been more satisfactory if the CAD could pre-empt these requirements and include them into the tender specifications

during preparation for the tender documents. On the other hand, the ICAO Global Air Navigation Plan (GANP) promulgated in November 2012 contained the latest ATM requirements which could not be predicted beforehand. Hence, it was required to enhance the ATMS in 2013 so as to cope with the latest requirements.

Operation of the existing ATC system

22. Since 2011, the CAD has worked closely with system suppliers and maintenance service providers to progressively implement a series of maintenance measures on the existing ATC system in order to sustain the reliable and efficient operation. In view of the delay in new ATMS project, commencing this year the CAD has stepped up efforts to strengthen its maintenance on the existing ATC system. Measures included upgrading the relevant surveillance data display (SDD) workstations and optimizing radar signal inputs to alleviate system loading etc., which was planned for completion within this year. According to the CAD's estimation, with the aforesaid measures in place, the existing ATC system should maintain safe and reliable operation to cope with the air traffic capacity in Hong Kong.

23. The CAD has been attaching paramount importance to the issues mentioned in the audit report related to existing ATC systems, such as surveillance data display problems (e.g. frozen/hang-up) at

some controller positions. While such occurrences do not have substantial impacts on air traffic control, the CAD has taken immediate and decisive measures to deal with the problems in order to upkeep the performance of relevant system.

Civil Aviation Department

December 2014

Details of systems and facilities for the eight contracts of the new Air Traffic Control (ATC) system

Eight contracts of the new ATC system	Details of systems and facilities
(a) Air Traffic Management System (ATMS) Contract variation No. 1 Contract variation No. 2	Radar Data Processing and Display System/Flight Data Processing System (RDPDS/FDPS), Radar Data Formatter, Radar Simulator for RDPDS/FDPS and Computer-Based Training (CBT) System
(b) Air Traffic Services Data Management System	Secondary Surveillance Radar Situation Display System, Aeronautical Information Database, Cable/Microwave Link Network and Other Ancillary Systems/Facilities
(c) Aeronautical Information Management System	Aeronautical Information Database
(d) Aeronautical Messaging System	Air Traffic Services (ATS) Message Handling System and Aeronautical Telecommunication Network
(e) Communication Backbone	Master Clock System and Cable/Microwave Link Network
(f) Communications and Recording System	Speech Processing Equipment, Voice Recording/Playback System and ATC Radio Telephony Workload Monitoring System
(g) Relocation and Expansion of ATS Message Handling System	ATS Message Handling System and Aeronautical Telecommunication Network
(h) Ancillary and Technical Support System	Centralised Monitoring and Control System, Telephone System, Un-interruptible Power Supply System and Cable/Microwave Link Network

Item No.	Critical Tasks as listed in Annex B of discussion paper of the Panel on Economic Services of the Legislative Council [Paper Ref. : CB(1)966/06-07(04) - 26/2/2007]	Original Schedule	Actual / Tentative Schedule	Reason(s) for change
1	Define overall system design and operational requirements including the human-machine interfaces for some 17 major components and other ancillary facilities of the ATC system	2007-08	2007-08 (actual)	--
2	Liaise with adjacent ATC authorities on the interface and protocol standards for the inter-operability of the new ATC system with their systems	2007-08	2007-08 (actual)	--
3	Define training requirements in the tender and contract specifications for the various components and ancillary facilities	2008-09	2008-09 (actual)	--
4	Formulate the training plan for the operations of the new ATC Centre and revised flight procedures	2008-09	2008-09 (actual)	--
5	Prepare tender documents for the procurement of the various components and ancillary facilities	2008-09	2008-11 (actual)	The new ATC system composes of 8 major project items, which are implemented in phases by the CAD. After completion of Items (1) to (4) above, there were more specific requirements than expected which must be included in the tender documents, including the latest technical and safety requirements, the operational needs of air traffic controllers, and the connection interface with other systems. The CAD had to work in conjunction with Department of Justice and Government Logistics Department to prepare and review details of the tender document. To ensure that the latest requirements would be suitably incorporated into the tender document, the CAD had to carefully review every details of the tender documents, and submit them to the Government CTB for approval. Therefore, time taken for tender preparation was longer than expected.
6	Conduct tender evaluations and award contracts for the various components and ancillary facilities	2009-10	2009-12 (actual)	Consequential delay incurred due to Item (5) above
7	Participate in the "train-the-trainer programme" in the factories of the various equipment suppliers	2009-10	2012 (actual)	Consequential delay incurred due to Item (5) above
8	Prepare the training materials to suit Hong Kong's traffic configuration and operating environment, including the system degradation on failure, and failure recovery procedures	2009-10	2012 (actual) - 15 (tentative)	Consequential delay incurred due to Item (5) above. Moreover, training plan was also affected by the contract variations of the Air Traffic Management System (ATMS) in 2012 and 2013.
9	Draft course plans for subsequent training of operational controllers in various operational streams	2009-10	2012 (actual) - 13 (actual)	Consequential delay incurred due to Item (5) above
10	Formulate the work plan for transition and parallel operations of the two ATC Centres	2009-10	2009-10 (actual)	--
11	Monitor the production of the relevant equipment, attend factory acceptance testing, and supervise the site installations	2010-11 and onwards	2010-11 and onwards	The entire new ATC system include 8 major project items, 7 of which have been substantially completed as scheduled. For the remaining ATMS, in view of contract variations for system enhancement, Factory Acceptance Test was deferred until 2012.
12	Carry out the site testing, acceptance and integration of the various components and ancillary facilities	2010-11 and onwards	2010-11 and onwards	Apart from being affected by Item (11) above, the ATMS is a very complicated and sophisticated system requiring longer time than expected for testing. Therefore, Site Acceptance Test was deferred to start until 2014.
13	Conduct classroom and hands-on training and refresher courses on operating the new ATC system and revised operational and flight procedures	2010-11 and onwards	2013 (actual) and onwards	Consequential delay incurred due to Items (11) and (12) above
14	Provide relief for more than 200 operational controllers who will have to undergo training related to the new ATC system in batches	2010-11 and onwards	2013 (actual) and onwards	Consequential delay incurred due to Items (11) and (12) above
15	Design and carry out drills for the ATC Centre transition and parallel operations	2010-11 and onwards	2012 (actual) and onwards	Consequential delay incurred due to Items (11) and (12) above
16	Plan and execute the transition between the existing and new ATC Centres and their parallel operation at the initial stage	2010-11 and onwards	2012 (actual) and onwards	Consequential delay incurred due to Items (11) and (12) above

Note : The entire new ATC system composes of 8 major project items, 7 of them have been substantially completed as scheduled. Two of them have been put into operations since 2013. The other 5 project items would also be under phased operations starting 2015.

Flow Chart of new ATM
(From Legco FC funding approval to contract award)

