APPENDIX 11



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Lantau, Hong Kong

香 港 特 別 行 政 區 政 府 The Government of the Hong Kong Special Administrative Region 3 April 2017

Clerk to the Public Accounts Committee Legislative Council Legislative Council Complex 1 Legislative Council Road Central, Hong Kong

(Attn: Mr Anthony CHU)

Dear Mr CHU,

Follow-up to Public Accounts Committee Report No. 63A Administration of the Air Traffic Control and Related Services Visit to CAD on 15 March 2017

Thank you for your letters dated 10 and 14 March 2017 enclosing lists of questions on "Administration of the air traffic control (ATC) and related services". Our replies in response to your questions are provided at *Annex 1* to this letter.

I would also like to take this opportunity to thank the Chairman and the Honorable Members of the Public Accounts Committee (PAC) for spending their valuable time to visit our ATC facilities and exchange views with us on the ATC system on 15 March 2017. We trust that the visit has provided the PAC with a better understanding of our ATC operations and the proven capability of the new ATC system in handling increasing air traffic movements as shown in the recent peak travel periods.

As you are aware, we have established an Expert Panel, comprising local and overseas experts in the fields of air traffic management, engineering and aviation safety management, in December 2016 to offer expert advice to the Department on teething issues encountered since the full commissioning of the new Air Traffic Management System (ATMS), which is part of the ATC system, and to share international experience and best practices. The Expert Panel has since held four meetings and paid visits to our ATC operational and training facilities. Expert Panel members have also met with frontline air traffic controller representatives, air traffic system engineer representatives and management pilots of the Government Flying Service and major local air operators to listen to their views regarding the operations of the new ATMS.

Having reviewed the performance of the ATMS and consulted the said stakeholders in the past few months, the Expert Panel has come up with an Interim Report, which was issued on 3 April (*Annex 2*). The Expert Panel is of the view that as the new ATMS is a large-scale and complicated, comprehensive computer system, minor teething issues would occur intermittently for different reasons (including human factors). These issues did not affect the operations of the ATMS, nor did they affect ATC operations or aviation safety. After evaluating the relevant occurrences, the Expert Panel considered that safety performance of the new ATMS, so far, exceeded international requirements. The Expert Panel urged the CAD to continue to stay vigilant and to further optimise the system taking into account, among others, views of frontline staff.

Please rest assured that the CAD will spare no efforts in the optimisation work of the new ATMS in consultation with the Expert Panel and with the engagement of frontline staff. A Final Report will be prepared and published by the Expert Panel upon the expiry of its term in end November 2017. We will be pleased to share a copy of the Final Report with the PAC when it is ready.

Yours sincerely,

(Captain Victor LIU) for Director-General of Civil Aviation

Encl.

c.c. Secretary for Transport and Housing Secretary for Financial Services and the Treasury Director of Government Logistics Director of Audit

*<u>Note by Clerk, PAC</u>: Annex 2 not attached.

<u>Response to Questions raised by the PAC</u> <u>in the letter dated 14 March 2017 to the CAD</u>

Parts A & B: Warranty & Maintenance

- 1. At what date did the warranty of the Air Traffic Management System ("ATMS") begin to run?
- 2. How long is the warranty for?
- 3. What is the maintenance fee payable after the warranty period has expired?
- 4. We understand that in some countries the warranty arrangement for air traffic control systems is based on a "ticket" system rather than a time basis, does this ticket system apply to ATMS?
- 5. Is maintenance of the system carried out by Raytheon?
- 6. If not, why not and who carries out the ATMS maintenance?
- 7. Do you have separate maintenance for the software and hardware of ATMS?
- 8. How many Raytheon staff are stationing in Hong Kong to perform the maintenance service?

CAD's reply:

The hardware and software maintenance of the new air traffic management system (ATMS) consists of two levels, i.e. day-to-day/frontline maintenance, and faults/deficiencies identification and rectification. These two levels of maintenance work are provided by the maintenance service provider of the air traffic control (ATC) system (i.e. PCCW) and the ATMS contractor (i.e. Raytheon) respectively. Both parties are responsible for different contractual work scopes and provisions in areas of hardware and software maintenance, which are specified under the respective contracts.

As far as the ATMS (which is part of the ATC system) is concerned, the Hong Kong-based contractor, PCCW, undertakes regular frontline on-site maintenance on the ATMS to ensure that the equipment is kept operating smoothly. This includes 24-hour watch-keeping, regular preventive maintenance, corrective maintenance and procurement/management of consumable and spare items.

On the other hand, Raytheon is required to provide assistance to the maintenance personnel from the CAD and PCCW in the areas of:

a) dealing with and rectifying all faults or deficiencies, or with faults or deficiencies not previously encountered by the Government and which are not dealt with in the maintenance documentation (i.e. written maintenance procedures for maintenance staff's reference) within the response time specified in the ATMS contract;

- b) finding the cause(s) of those faults that occur repeatedly and preventing further occurrences within the response time specified in the ATMS contract; and
- c) carrying out corrective action (including changing the source code of the software) for any fault, deficiency, unacceptable or undesirable behaviour and/or side-effect found in the software, and updating the corresponding documentation.

The aforesaid maintenance arrangements are basically in line with those for the old ATMS.

Depending on the circumstances and service needs, Raytheon has been providing on-site technical support, ranging from one to four staff, as well as remote expert support from the Raytheon factory in the United States, on the transition, operations and maintenance of the ATMS. With the permission of the CAD, Raytheon may gain remote access to traffic data and replay traffic scenario for post-occurrence analysis in their facilities. For example, during transition from the old ATMS to the new ATMS in November 2016, Raytheon provided on-site and remote expert support to the transition. After the new ATMS was put into operational use, Raytheon has been providing post-transition expert support to follow up on teething issues and to ensure that the ATMS is operating smoothly, especially during the high traffic periods from December 2016 to February 2017.

Regarding the hardware and software warranty of the new ATMS, we assume that the question refers to the warranty provided by the system contractor, i.e. Raytheon. As mentioned in CAD's reply dated 15 January 2015 to the PAC, the hardware warranty and software warranty periods of the new ATMS provided by Raytheon last for 2 years and 5 years respectively. In accordance with the contract, the hardware warranty and software warranty periods of the new ATMS Phase 1¹ project have commenced on the date of acceptance of the new ATMS (Phase 1) on 11 November 2015, and will expire on 10 November 2017 and 10 November 2020 respectively. In other words, the new ATMS is

^{Note1} As mentioned in CAD's reply dated 25 March 2015 to the PAC, Phase 1 of the ATMS project refers to the new ATMS being installed and commissioned at the new Air Traffic Control (ATC) Centre in the CAD Headquarters building, while the Phase 2 project refers to the new ATMS to be installed and commissioned at the old ATC centre as a back-up of the new ATC system.

still within the warranty periods at the moment and no additional maintenance charges are payable to Raytheon.

After the expiry of the respective warranty periods, the CAD has an option to subscribe for maintenance services offered by Raytheon. Beyond the respective warranty periods, the annual hardware and software maintenance costs for the new ATMS (Phase 1) are US\$21,401 and US\$506,078 respectively. The CAD will consider whether or not to procure the maintenance services after further assessment and subject to operational needs.

If the CAD considers it necessary to procure maintenance services for the new ATMS from Raytheon beyond warranty period, such services would be procured on a time basis. A time-based maintenance service contract would cover all the follow-up work needed for addressing abnormal issues originated from the system design.

Part C: System Safety

- 1. Are all safety systems/functions² of ATMS fully activated?
- 2. If not, can you give an explanation why some of the safety systems/functions have not been activated?
- 3. Has the frequency of system stalling increased after the Electronic Flight Strip ("EFS") system is migrated from Autotrac I to Autotrac III? If yes, please provide details.
- 4. Whether it was necessary for the Civil Aviation Department ("CAD") to manually restart the EFS system after migration? If yes, the number of manual restart after migration?

CAD's reply:

All air traffic control officers (ATCOs) have been trained to rely on information provided in the ATMS and operational procedures to maintain safe separation among aircraft. Safety net features aim to provide additional levels of assurance in alerting ATCOs to any potential infringement of pre-defined safety margins. The new ATMS is equipped with a total of 10 safety net features as tabulated below, which have successfully passed the acceptance tests:

Safety Net Feature	Description
Special Use Airspace Intrusion Warning	The SUAIW is to indicate any infringement of an aircraft flying into a special airspace defined by the user.

² Safety functions include i) Short Term Conflict Alert; ii) Similar Callsign Warning; iii) Special Use Airspace Infringement Warning; iv) Minimum Safe Altitude Warning; v) Cleared Level Adherence Monitor; vi) Route Adherence Monitor; and vii) Medium Term Conflict Detection.

Safety Net Feature	Description
(SUAIW)	
Similar Callsign Advisory (SCA)	The SCA provides visual alerts in a list display on detection of similar aircraft identification operating under a controller.
Short Term Conflict Alert (STCA)	The STCA generates alerts on the infringement and potential infringement of user-adaptable separation standards (area of conflict) between 2 or more aircraft at any time.
Cleared Level Adherence Monitoring (CLAM)	The CLAM generates visual alert when the level of an associated track exceeds the defined tolerances of its cleared level
Route Adherence Monitoring (RAM)	The RAM generates visual alert when an associated track leaves the defined track keeping tolerances of its cleared route.
Minimum Safe Altitude Warning (MSAW)	The MSAW provides alerts controllers on aircraft proximity to terrain with reference to the minimum safe altitude for each MSAW Defined Area.
Departure Path Monitoring (DPM)	The DPM monitors the flight trajectory of departing aircraft from each runway and generates visual and audio warning when a departing associated track leaves the required track keeping tolerances.
Position Report Monitoring (PMON)	The PMON alerts the controller when the ATO and/or ETO next point stated in the position report differ from that calculated by the flight trajectory by more than a user-adaptable time interval.
Approach Path Monitoring (APM)	The APM monitors the defined 3-dimensional approach paths for each approach of the North and South runways at HKIA.
Medium Term Conflict Detection (MTCD)	The MTCD allows the user to adapt the separation standards required between aircraft in each of the MTCD defined volume of airspace.

Note: The three shaded safety net features in the table have been implemented and put into operational use since the full commissioning of the new ATMS in November 2016.

In accordance with the requirement of the International Civil Aviation Organisation (ICAO) Safety Management System that changes involved in transition of ATC systems need to be managed in order to reduce the associated risks, the CAD, like other civil aviation authorities or air navigation service providers, will implement appropriate safety net features incrementally based on local operational environment and needs. In the old ATMS, only two safety net features, namely STCA and SUAIW, were implemented for operational use, and both have been implemented in the new ATMS. The CLAM, a newly developed feature with the advancement of aviation technologies, has also been implemented since the full commissioning of the new ATMS on 14 November 2016, providing ATCOs with an additional tool to improve their situational awareness.

As mentioned above, the CAD has been adopting an incremental approach in the implementation of safety net features in the ATMS to minimise the risk involved in transition to the new ATMS, and to best suit the operational needs of ATCOs. It is the Department's plan to gradually prepare and implement the remaining safety net features in the ATMS in accordance with the requirements and procedures of the ICAO's Safety Management System, so as to provide the ATCOs with additional tools in enhancing safety. Such approach is supported by the relevant staff members involved in the ATMS development and operation, such as ATCOs and Electronic Engineers.

The implementation of safety net features is required to go through a series of processes covering functional evaluation, database creation, adaptation of parameters, testing, operational trials, optimisation, flight check (if applicable) and safety assessment. These processes will be conducted in line with the ICAO requirements and international best practice to ensure the activated safety net will not generate excessive false alerts causing nuisance to ATCOs.

All along, aviation safety has been maintained through ATCOs' professional knowledge, competence, and operating procedures with the aid of safety net features. The remaining safety net features are being reviewed regularly according to operational environment and needs to determine their priorities and implementation plan. This is also in line with one of the recommendations made by the ATMS Expert Panel in its Interim Report that "on deployment of software fixes/enhancements, CAD should prioritise the items and implement those changes prudently in order to minimise unnecessary risks while introducing any changes".

On the Electronic Flight Strip (EFS) System, the function of the system is to display flight information to ATCOs in flight strip format electronically, with automated/manual updating and posting features, replacing the conventional paper flight strips. It is supplied by an Austrian company, and was a standalone system in operational use at the ATC Tower since 2012 when the old ATMS was in operation. The new ATMS has incorporated the EFS System at the ATC Tower as one of its sub-systems, and adopted a similar application to cover also the ATC Centre.

The EFS System at both the ATC Tower and ATC Centre has been running smoothly in general since the full commissioning of the new ATMS in November 2016. ATCOs are generally satisfied with the performance of the EFS System.

So far, there has been one incident with the EFS System after the full commissioning of the ATMS. On 18 December 2016, there was an intermittent flight plan data exchange problem between the EFS System at the ATC Tower and the operational ATMS at the ATC Centre, affecting departure flights. The tower workstations could not process the flight plan data of some departure flights and relevant information had to be provided by the ATC Centre temporarily. However, the operations of the ATMS and the ATC Centre were not affected. It resumed normal operation after it had been fixed and re-booted, i.e. manually restarted by air traffic engineers/maintenance staff. Aviation safety was not undermined. After investigation by the ATMS contractor (i.e. Raytheon), the issue was identified to be caused by a software glitch in the EFS System leading to memory utilisation problem. The EFS System resumed normal operation after the servers were re-booted.

The CAD has already put in place regular housekeeping measures by maintenance staff since the above occurrence. It has also recently implemented a software fix (developed by the Austrian supplier of the Tower EFSS in collaboration with Raytheon) in March 2017 to address the issue. Since the implementation of regular housekeeping measures by maintenance staff. there has been no recurrence of stalling of the EFS System/manual-restarting of the EFS System. The Transport and Housing Bureau (THB) has invited its independent consultant, the National Air Traffic Services (NATS) from the United Kingdom, to review the occurrence. NATS noted the identified cause of the occurrence and that a permanent software fix has been implemented. Overall speaking, NATS found CAD's engineering and ATC responses effective and proportionate in responding to and resolving the issue. NATS' detailed report is being reviewed by THB. The ATMS Expert Panel has looked into this matter, as well as NATS' assessment, and considered the remedial measures taken have addressed the issue satisfactorily.

Part D: ATMS Expert Panel

1. Has the ATMS Expert Panel suggested forming an Autotrac III user group? If yes, please provide details of this user group, such as the organizer, purposes, when and where it will meet, and the costs borne by CAD, if any.

CAD's reply:

Forming an AutoTrac III user group is not among the recommendations made by the ATMS Expert Panel. That said, user groups or other exchange platforms of similar nature are useful and beneficial for all existing and potential users of various computer systems in relation to ATC services to share operational and technical experience, and to enhance users' operations and map out future system implementation, particularly at the early stage of development of new system. As a matter of fact, a user group for the old ATMS was formed back in late 1990s.

Regarding the new ATMS, CAD is enquiring if other users of the AutoTrac III and Raytheon products (e.g. Dubai, the United States, India, etc.) are interested in organising a user group.

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