

**For discussion
on 24 March 2016**

Legislative Council Panel on Economic Development

**New Air Traffic Control System
in Civil Aviation Department**

Purpose

This paper informs Members of the latest progress on the replacement of the Air Traffic Control (ATC) system at the Civil Aviation Department (CAD).

The New ATC System

2. The aim of installing the new ATC System is to enhance CAD's capability in air traffic management in order to satisfy the robust increase in service demand. The capability of the new ATC System is designed to meet the latest international standards on technical, safety and ATC operational requirements. It can also handle the projected air traffic increase brought by the development of the Three-Runway System (3RS) of the Hong Kong International Airport.

New Features of the New System

3. As a centerpiece of the new ATC System, the new Air Traffic Management System (ATMS) is developed by Raytheon, a United States-based company specialising in air traffic management technology. Raytheon is also the developer of the existing ATMS in CAD. The company's ATC systems/products are used by many major airports around the world. The new ATMS procured by CAD can handle 8 000 flight plans per day and can simultaneously monitor 1 500 air or ground targets (5 times and 1.5 times of the existing system respectively), making it fully capable of coping with air traffic growth even under 3RS operation in future. The new ATMS is provided with the latest information technologies, including enhanced flight information and data processing, advanced automatic safety net features, and more precise flight trajectory prediction functions.

Procurement Process and Details of the Contract

4. CAD selected the supplier of the new ATMS through a global and open tendering exercise, which was fully in compliance with the tendering procedures of the Government. Raytheon's system developed for Hong Kong meets the latest requirements set by the International Civil Aviation Organization (ICAO), and is on par with the most advanced international air traffic management technologies.

5. The new ATC System is implemented through a total of eight system contracts¹, of which seven have been completed and commissioned in phases since 2013. These seven systems have been running smoothly. The remaining contract covers the new ATMS, which is expected to be ready for operational use in mid-2016.

Readiness Assessment

6. The new ATMS is at its final stage of preparation for rollout. When assessing the readiness for launching the new ATMS, CAD takes into account two major factors, i.e. the readiness of the system *per se*, and the readiness of staff operating the system.

(i) System Readiness

7. In preparation for the implementation of the new system, CAD has conducted stringent acceptance tests² on the new ATMS on par with international aviation safety management standards and established Government procedures, as well as to ensure that the system operation is in compliance with the contract conditions and safety management requirements. Acceptance test

¹ The eight contracts include Air Traffic Management System, Air Traffic Services Data Management System, Aeronautical Information Management System, Aeronautical Messaging System, Communication Backbone, Communications and Recording System, Relocation and Expansion of ATS Message Handling System, and Ancillary and Technical Support System.

² Acceptance tests include the following components:

- (a) **Factory Acceptance Tests** – to demonstrate that under the simulated environment specified in the agreed test procedures, the ATMS would generally be compliant with the technical and operations requirements specified in the Final System Specification.
- (b) **Site Acceptance Tests** – to demonstrate that the system was capable of complying with every clause of contract specifications.
- (c) **Flight Check Acceptance Tests** – to verify the accuracy of the displayed targets flying within the Hong Kong Flight Information Region.
- (d) **Reliability Acceptance Tests** – to verify the reliability of the new ATMS including software and hardware through continuous 31-day normal operations.
- (e) **System Integration Tests** – to verify the compatibility and interoperability of the new ATMS with other ATC Systems.

events of the new ATMS were completed in September 2015. CAD is generally satisfied with the test results. Follow-up work is being conducted. Moreover, all outstanding priority items identified during the test events have been fully addressed by the contractor to ensure safe commissioning of the new ATMS. A detailed work plan is at [Annex](#).

(ii) Staff Readiness

8. Staff readiness is critical in ensuring that the new ATMS will work properly and effectively. CAD attaches great importance to enhancing staff confidence and competence through extensive training and staff communication. CAD has formulated a comprehensive training plan which consists of a series of intensive training sessions for air traffic controllers and relevant staff in phases through the use of simulator system and familiarisation training on the new ATMS. So far, around 30 training sessions on ATC operations for all licensed controllers have been completed. Staff performance and confidence on the use of the new system are improving and CAD is generally satisfied with the progress. Comments from staff are reported back to the project team to further enhance the functionality of the new ATMS.

9. CAD also notes that while staff generally welcome the new ATC System as a whole, they see the need for more training opportunities given substantial changes in the mode of operation of the new ATMS as compared to the existing one. Hence, further training sessions have been provided since March 2016 to enhance staff confidence and competence level. To further familiarise air traffic controllers with the environment and performance of the new ATMS, CAD is conducting shadowing tests whereby frontline air traffic controllers use the new ATMS (and the new ATC System as a whole) to mimic real time air traffic operations carried out by the existing ATC System at the existing ATC Centre.

Close Monitoring

10. Under the safety-first principle, the Transport and Housing Bureau (THB) and CAD are taking extra care in ensuring smooth and seamless transition to the new ATC System.

11. At CAD, the Deputy Director-General of Civil Aviation chairs a Steering Committee which comprises heads of all relevant functional teams involved in the installation and testing of the new ATC System, and the training of ATC personnel. This Steering Committee regularly reports the progress and the readiness of the new ATC System to the Director-General of Civil Aviation

(DGCA). THB has been monitoring the progress of the project closely and receives regular update reports from DGCA.

Advice from External Consultants

12. To further ensure safety management and operational readiness of the new system, independent consultants have been appointed to assess and ascertain the system readiness and human factor effectiveness of the project.

13. CAD engaged EC Harris³ in 2012 to provide expert advice and conduct safety assessment workshops for colleagues involved in formulating the safety case report on the design, implementation and transition of the new ATC System. EC Harris has completed its tasks and recommended a framework of actions for formulating the safety case report⁴. The framework will be adopted by CAD in compiling the report for internal assessment as required by the ICAO.

14. THB has separately engaged National Air Traffic Services (NATS)⁵ of the United Kingdom (U.K.) in November 2015 to assess system and staff readiness and render independent advice to the Secretary for Transport and Housing (STH) as an additional check point in ensuring safety, reliability and stability of the new ATMS operations.

15. NATS completed a “snapshot” review based on the situation in December 2015 on the system technical aspects, operations and training documents of the new ATMS, as well as making reference to EC Harris’ work. It also conducted a one-week on-site assessment and interview with CAD staff. According to NATS’ assessment, the system engineering is safe, stable and reliable, and on par with good practice in ATC centres in other jurisdictions, such as the U.K. and Singapore, although a few observations were noted mainly

³ EC Harris is an international built asset consultancy firm based in the U.K. It provides consultancy services on, *inter alia*, engineering and air traffic management. Its clients include the European Organisation for the Safety of Air Navigation (EUROCONTROL), U.K. Civil Aviation Authority, U.K. Royal Air Force, Irish Aviation Authority, Air Services Australia and Civil Aviation Authority of Denmark.

⁴ According to the ICAO requirements, air navigation service providers are required to conduct safety assessment on changes to systems to ensure safe delivery of aviation services.

⁵ NATS is the leading Air Navigation Services Provider (ANSP) in the U.K., serving 14 U.K. airports. It has extensive experience in providing air navigation services, en-route and airport operations, aviation information management services, etc. It has completed operational transition of two major ATC Centres in the U.K. (namely, Swanwick and Prestwick) before. NATS also has a rich history of providing consultancy for other ANSPs to enhance performance and safety to enable more resilient and higher capacity services in countries such as Spain, Singapore, Australia, India, Oman and Qatar. NATS benchmarks its evaluation standards with other ANSPs and the Civil Air Navigation Services Organization (CANSO), the International Air Transport Association (IATA) and ICAO. NATS has a local presence in Hong Kong and is familiar with the ATC operational environment in Hong Kong.

related to documentation of engineering plans and reports, and procedures for system maintenance in the long run. These issues will be fully addressed before the complete implementation of the system. On human factor, NATS has observed that there are some aspects that have to be refined to cater for user preference and operational effectiveness (such as font size, audio alert sounds for different situations, overlapping of aircraft data label on-screen), prior to the actual commissioning of the new ATC System so as to ensure smooth delivery of service. Some of these human factor issues have already been addressed by the latest software change, while others will be handled in the forthcoming training for air traffic controllers. It should be noted that, as remarked by NATS, the number and level of observations and recommendations raised by NATS are not unusual in relation to their experience of ATC transitions at a similar stage of development.

16. Against the above, NATS has suggested, among others, the possibility of a phased functional implementation of the new ATC System which may allow more time for ATC staff to familiarise themselves with the system's functions and operations in phases, and to minimise the risk of providing full functional services during the typhoon season which would induce additional workload and pressure on ATC staff.

Phased Transition to the New ATC System

17. CAD sees merits in NATS's recommendation on phased functional implementation, considering in particular the heavy volume of air traffic which the Department has to manage every day. This approach will allow staff to gradually familiarise themselves with the new operating environment, and be more focused when dealing with safety issues (such as inclement weather during the typhoon season). It will also further enhance staff confidence, allow more time for staff to adapt to the new working environment and relieve their pressure during an extended period of transition.

18. Taking into account NATS's suggestion and CAD's own assessment on the overall operational readiness in terms of system safety, reliability, stability, and integrity requirements, CAD's current plan is to ***launch the new ATMS incrementally from June 2016 onwards***. The use of the new ATMS will be progressively expanded in terms of operating time and the scope of service coverage over a period of about five months. Subject to actual experience and progress, and upon STH's final consent, based on independent consultant's advice, the new ATMS will be fully commissioned and operated by October/November 2016. More details of the phased functional implementation are as follows:

- (a) As the first step in a phased commissioning arrangement, the new ATMS will be used to support ATC Tower operations, which manage live air traffic operating in the vicinity of the Hong Kong International Airport, in June 2016, while in parallel other ATC services will continue to be delivered by the existing system. Initially, the new ATMS will be used for Tower function at selected control positions in the Tower for two to three hours a day during non-peak periods.
- (b) Progressively in July 2016, real live traffic operations using the new ATMS will be extended to include all control positions in the Tower and carried out at different times of the day. Reviews will be conducted after each and every operation day to ensure smooth operations and procedural improvement in subsequent sessions.
- (c) From August to October 2016, the phased implementation will be extended to cover other ATC functions, namely Area, Terminal and Approach⁶ in the new ATC Centre. Similar to Tower operation, real live traffic operations will start with selected control positions to gradually cover all control positions in Approach/Terminal functions, Area function, and eventually the whole new ATC Centre. The existing ATC Centre will then be used as a backup.
- (d) The phased functional implementation of the new ATMS should be completed by October/November 2016. The existing ATC System will serve as a back-up for around six months in accordance with the international practice. CAD will review the operational performance of the new system in due course to decide if the back-up period needs to be extended.

Way Forward

19. The phased functional implementation arrangement as outlined in paragraph 18 above represents a step-by-step incremental approach to ensure system readiness and staff confidence, and to manage possible risks involved in the process more effectively. CAD is finalising a detailed implementation plan comprising the dates for making critical decisions, a checklist of key performance indicators leading to the green light for implementation, reporting/authorisation arrangement, contingency plan, etc.

⁶ Approach functions refer to ATC services provided to air traffic, mainly Hong Kong arrivals and departures, operating in airspace within 50 Nautical Miles of the Hong Kong International Airport. Terminal functions refer to ATC services provided to air traffic operating in airspace beyond 50 and up to around 120 Nautical Miles of the Hong Kong International Airport. Area functions refer to ATC services provided to air traffic operating in airspace beyond 120 Nautical Miles of the Hong Kong International Airport.

20. THB and CAD will further critically review system safety, staff readiness and resources requirement in the coming two months or so before finalising the transition arrangement to commence in June 2016. The review will fully take into account the independent consultant's and CAD's own assessments, as well as weather conditions nearer the time. THB will engage a consultant to conduct a further round of independent assessment on the overall scheme of phased functional implementation and readiness of various safety documents alongside the final stage of staff training scheduled in the second quarter of 2016. The ultimate aim is to ensure that the new ATMS will be launched only when CAD has attained the highest level of system and staff readiness.

**Transport and Housing Bureau
Civil Aviation Department
March 2016**

Detailed Work Plan for Transition of Existing ATMS to New ATMS

Schedule	Major Activity
September 2015 (Note 1)	<p>Completion of all the acceptance tests of the new ATMS – The final acceptance test event for the new ATMS was completed in September 2015, and CAD is generally satisfied with the test results.</p>
July 2015 to July 2016	<p>Training on ATC operations and staff consultation sessions</p> <ul style="list-style-type: none"> • to provide training on “Area”, “Approach” and “Tower” disciplines in the simulator system – <i>on-going</i> • to provide training on ATC operations using the new ATMS – <i>on-going</i> • to provide briefings to and collect feedbacks from frontline staff on the new ATMS and other associated ATC Systems – <i>on-going</i> • to regularly review the training needs of staff and adjust the training plan as necessary to ensure ATC staff are competent to operate the new ATMS – <i>on-going</i>
September 2015 to October 2016	<p>Shadowing tests/Operations</p> <ul style="list-style-type: none"> • to mimic air traffic handling using the new ATMS during system software tests or normal ATC operations, while air traffic operations are taking place in the existing ATC Centre using the current ATMS – <i>on-going</i>
November 2015 to March 2016 (Note 2)	<p>Independent Consultancy</p> <ul style="list-style-type: none"> • THB appointed NATS to render independent advice to STH on system and staff readiness, with recommendations given, based on a “snapshot” review in December 2015. • Based on NATS’ recommendation, CAD is formulating a plan to <i>launch the new ATMS incrementally</i> from June 2016 onwards to October/November 2016 – <i>in progress</i>
Mid 2012 to Mid 2016	<p>Safety Assessments on new ATMS, and Implementation & Transition of new ATC System</p> <ul style="list-style-type: none"> • CAD to engage an external consultant to provide advice and guidance on safety case reports- <i>completed in December 2015</i> • to make ready the relevant safety documents in phases in supporting phased transition during June to October/November 2016 – <i>in progress</i>

Schedule	Major Activity
June 2016 to October 2016	Phased Functional Implementation <ul style="list-style-type: none"> • to operate the new ATMS to handle live air traffic in a controlled and progressive manner (i.e. live air traffic handling by individual ATC units/sectors using the new ATMS, e.g. Control Tower) leading to full commissioning.

Note 1 : These activities were conducted in line with the ICAO and international best practice to ensure a seamless ATC System transition as well as safe, stable and reliable system operations.

Note 2 : NATS has put forward a recommendation on phased transition of ATMS. Accordingly, CAD has taken the advice from NATS with preparation work underway to launch the new ATMS incrementally from June 2016 onwards to October/November 2016.