



航空交通工程服務 Air Traffic Engineering Services

航空交通工程服務部負責設計、規劃、統籌、提供、驗收、優化和保養航空交通管制系統(空管系統)與通訊、導航及監察設施。

The Air Traffic Engineering Services Division (AESD) is responsible for the design, planning, coordination, provision, commissioning, enhancement and maintenance of air traffic control (ATC) systems as well as communications, navigation and surveillance facilities.



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更換空管系統

舊空管系統於一九九八年香港國際機場啓用時投入服務，運作已超過18年。為應付預期的航空交通需求，本處於二零零七年獲立法會撥款15.65億元更換舊空管系統。整個新空管系統透過八份主要合約實施。隨着新航空交通管理系統(航管系統)於二零一六年十一月全面投入服務，設於東航空交通管制中心(東空管中心)及北空管指揮塔(北指揮塔)的八個主要系統業已全部投入運作。

運輸及房屋局(運房局)在二零一五年十一月委聘獨立海外顧問，評估新航管系統與操作人員的準備狀況。民航處在考慮過運房局顧問的建議，以及內部對整體運作準備狀況的評估後，由二零一六年六月十九日開始採用分階段過渡方式(即分階段啓用新航管系統)，

Replacement of ATC Systems

The old ATC systems have been in use for over 18 years since the opening of Hong Kong International Airport (HKIA) in 1998. To meet the projected air traffic demand, the Legislative Council approved a provision of \$1.565 billion in 2007 for replacement of the old ATC systems. The new ATC systems are implemented through eight major system contracts. With the new Air Traffic Management System (ATMS) fully commissioned in November 2016, all of the eight major systems in East ATC Centre (E-ATCC) and North ATC Tower (N-TWR) have been put into operational use.

The Transport and Housing Bureau (THB) appointed an independent overseas consultant in November 2015 to assess the new ATMS and staff readiness. Taking into account the recommendation from the THB consultant as well as CAD's own assessment on the overall operational readiness, CAD adopted a phased transition approach, termed Phased Functional Implementation, starting from 19 June 2016 to manage live air traffic in a progressive manner.



循序漸進地以新系統處理實時航空交通。經評估所有因素包括員工準備情況和資源需求等已準備就緒後，新航管系統於二零一六年十一月投入運作。

自過渡以來，坐落於東空管中心及北指揮塔的新空管系統運作大致暢順，並成功處理聖誕及新年假期高峰期所增加的航班。鑑於新航管系統的複雜性，民航處成立了航管系統專家小組，成員包括五位本地和海外航管系統專家、學者和電子工程師。專家小組的職權範圍是就新航管系統投入運作後所遇到的問題和所須進行的優化工作，向民航處提供客觀和專業意見，並就新航管系統的長遠優化工作，與民航處分享國際經驗和最佳做法。專家小組的任期為一年，由二零一六年十二月至二零一七年十一月。

After assessing all relevant factors such as staff readiness and resource needs were ready, the new ATMS has been commissioned in November 2016.

Since the transition, the new ATC systems in the E-ATCC and N-TWR have been operating smoothly in general and successfully handled the increasing air traffic during the peak traffic period in the Christmas and Chinese Lunar New Year holidays. Given the complexity of the new ATMS, CAD set up an ATMS Expert Panel comprised of 5 members from local and overseas Air Traffic Management (ATM) experts, academics and electronics engineers. Their terms of reference are to provide objective and expert advice to CAD on teething issues arising from the commissioning of the new ATMS and the necessary optimisation work; and to share with CAD the international experience and best practices in relation to the long-term optimisation of new ATMS. The members are appointed for a one-year term from December 2016 to November 2017.



東空管中心的新空管系統投入運作。
The new ATC systems were commissioned at the E-ATCC for operational use.



二零一七年三月，泰國航空無線電公司主席率團到訪民航處，以期從香港新空管系統無縫過渡的經驗中借鏡觀形。

In March 2017, AEROTHAI President led the project team to visit CAD to draw on the experience in achieving seamless transition of new ATC systems in Hong Kong.

與海外空中導航服務提供者分享香港過渡至新空管系統的經驗

泰國航空無線電公司在二零一七年三月二十七至二十八日參觀民航處，從本港過渡至新空管系統的經驗中借鏡觀形，為泰國的通訊、導航及監察/航管系統現代化計劃作出更妥善籌劃。本部及航空交通管理部的專業團隊，以高度互動的方式，從技術和運作兩方面，開誠地與該公司的代表分享香港無縫交接至新空管系統的經驗。

重訂技術服務合約事宜

香港國際機場的空管系統，以及位於扯旗山、畢拿山和鶴咀的山頂無線電站通訊設施的十年維修保養技術服務合約，均在二零一六年九月三十日屆滿。民航處已於合約屆滿前公開招標，在獲得政府中央投標委員會核准後，兩份各為期十年新的技術服務合約在二零一六年第二季成功批出。隨着各項過渡安排順利完成，兩份新合約已按合約規定由二零一六年十月一日開始生效。

Experience Sharing on New ATC Systems with Overseas Air Navigation Services Provider

AEROTHAI visited CAD on 27-28 March 2017 to draw on CAD's experience in ATC systems transition to better prepare for their Thailand Modernisation CNS/ATM System (TMCS) transition project. Subject matter experts from AESD and Air Traffic Management Division had an open and highly interactive sharing, from both technical and operational aspects, with the delegates from AEROTHAI our experience in achieving seamless transition to the new ATC systems in Hong Kong.

Renewal of Technical Services Contract

The 10-year Technical Services Contracts (TSCs) for operations and maintenance of the ATC systems at the HKIA and communication facilities at hilltop radio stations located at Victoria Peak, Mount Butler and Cape D'Aguilar expired on 30 September 2016. Prior to the contract expiry, CAD mounted an open tender exercise. Upon approval given by the Government Central Tender Board, two new 10-year TSCs were successfully awarded in the 2nd quarter of 2016. With smooth completion of the transition-in arrangements, the two new TSCs have commenced since 1 October 2016 in accordance with contract requirements.

航空系統組塊升級

民航處根據國際民用航空組織(國際民航組織)的航空系統組塊升級框架,並考慮到亞太地區的《無縫空中交通管理計劃書》所訂定的優先次序,成功地與航空業界共同制定相關策略,分階段在香港實施各項組塊升級項目。年內,民航處繼續就航空系統組塊升級項目與持份者合作,並穩步發展,特別是先進場面活動引導和控制系統、廣播式自動相關監察系統和航空交通服務設施間數據通訊等項目。

持續發展安全管理系統,以提供穩妥的通訊、導航及監察服務和重要的屋宇服務設施

本部成功通過了航空交通管理標準組對安全管理系統進行的全面監管審查,並獲續發安全管理系統證書,效期由二零一六年一月至二零二零年十二月,為期五年。其後,本部於二零一六年六月舉行簡報會,與同事分享從中所得的寶貴經驗。年內,本部藉着舉辦安全訓練和推廣活動,繼續致力推廣安全意識。二零一六年十二月,本部安排同事參加由海外專家主講的有效安全管理課程,務求令處理安全管理系統的工作,不斷求進。

Aviation System Block Upgrades

In accordance with the International Civil Aviation Organization (ICAO) Aviation System Block Upgrades (ASBU) framework and after taking into consideration the priorities stipulated in the Seamless ATM Plan for the Asia Pacific region, CAD collaborated successfully with the aviation industry to develop strategies for phased implementation of ASBU modules in Hong Kong. Throughout the year, CAD continued working with the stakeholders on relevant ASBU modules and making steady progress, especially in the areas related to Advanced Surface Movement Guidance and Control System, Automatic Dependent Surveillance-Broadcast and Air Traffic Services Inter-facility Data Communication, etc.

Ongoing Development of Safety Management System in Support of the Provision of Safe Communications, Navigation and Surveillance Services as well as Critical Building Services Facilities

AESD passed the comprehensive Safety Management System (SMS) regulatory audits conducted by the Air Traffic Management Standards Office (ATMSO) and successfully renewed the SMS Certificate for another 5 years from January 2016 to December 2020. A briefing session was subsequently held in June 2016 to share with colleagues the valuable experience gained from the series of comprehensive regulatory audits. During the year, the division continued its momentum in safety promulgation through organising safety training sessions and promotional activities. In December 2016, with an objective to enhance the handling of SMS-related duties, the division arranged colleagues to attend the Effective Safety Management Course delivered by an overseas expert.



民航處處長李天柱於新的技術服務合約的簽約儀式上致辭。

The Director-General of Civil Aviation, Mr Simon Li, delivered a speech in the signing ceremony of the new Technical Services Contracts.



二零一六年六月，本部舉辦了一個簡報會，就通過一系列全面監管安全管理系統證書審查，與同事分享當中所獲得的寶貴經驗。
In June 2016, AESD held a briefing session to share with colleagues valuable experience gained from a series of comprehensive regulatory SMS certificate renewal audits.

本部繼續致力培育更多取得認可資格的內部審查員，藉以通過定期的內部審查和檢定，確保為空管系統提供持續的安全保障。本部亦全力配合航空交通管理標準組對衛星通訊、導航及監察/航管系統、外站運作，以及技術安全事故報告和調查程序所進行的審查和檢定工作。

本着積極主動進行安全監察的使命，本部按照國際民航組織的安全管理系統要求，定期審視和更新安全表現指標和目標。隨着新空管系統於二零一六年十一月啓用，本部在收集足夠的運作數據後，將會訂定一套新的安全表現指標和目標，以及制定有效的風險緩解措施。

To secure continuous safety assurance of ATC systems through regular internal audits and inspections, continuous efforts were made to expand the pool of approved internal auditors. The division also provided full support to the ATMSO's regulatory audits and inspections on the satellite-based CNS/ATM systems, outstation operations, and Technical Safety Occurrence (TSO) reporting and investigation processes.

In pursuit of proactive safety monitoring, the division conducted periodic reviews and updates of the Safety Performance Indicators and Targets (SPIs/SPTs) as per the ICAO SMS requirements. With the new ATC systems implemented in November 2016, a new set of SPIs/SPTs would be established through collection of sufficient operational data and formulation of effective risk mitigating measures.

推廣航空交通工程系統的網絡安全意識

航空交通工程系統是由多個相互連接的組件及子系統高度融合而成的網絡。儘管航空業界現時已就網絡安全採取一定的預防措施，但仍不可低估網絡安全事件的風險。

訂定適當的網絡安全策略對航空業界至為重要，國際民航組織制定了《航空交通管理安全手冊》（第9985號文件）和《航空保安手冊》（第8973號文件），為業界提供推行有效網絡安全措施的指引。

航空交通工程系統有可能會受到網絡安全威脅及成為目標，為了提高同事的意識，本部於二零一七年二月邀請了海外專家在民航處總部為各分部同事提供內部培訓。課程闡述了網絡安全的主要概念，介紹了國際民航組織的相關要求，概述了網絡安全事件的管理程序，還特別討論了航管系統內聯網，即「系統性信息管理」框架的網絡安全考慮因素。

二零一七年二月，本部邀請了海外專家，為各分部的同事提供航空交通工程系統網絡安全培訓課程。
In February 2017, AESD invited overseas experts to deliver a cyber security training course on air traffic engineering system for colleagues from different divisions.

Promotion of Cyber Security Awareness in Air Traffic Engineering System

The air traffic engineering system consists of a network of interconnected components and sub-systems with high degree of integration. Despite preventive cyber security measures currently adopted by the aviation industry, the risk of cyber security incident occurrence should not be underestimated.

Recognising the importance of defining an appropriate cyber security strategy for the aviation industry, the ICAO has prepared the Air Traffic Management Security Manual Doc 9985 and Aviation Security Manual Doc 8973 to provide guidance to the industry on the implementation of effective measures for cyber security.

To promote the awareness of colleagues in cyber security threats and vulnerabilities in air traffic engineering system, AESD invited overseas experts to conduct an in-house training course at the CAD headquarters in February 2017. The training elaborated key concepts of cyber security, introduced relevant ICAO's requirements, gave an overview of cyber security incident management process, and discussed in particular cyber security considerations of System Wide Information Management framework which is the intranet for ATM.



航空交通指揮塔的設計與建造培訓

為了作好準備，以展開三跑道系統項目中新航空交通指揮塔的設計與建造工作，本部安排了海外專家在二零一七年二月二十七日至三月三日期間，在民航處總部為各分部同事提供內部培訓。海外專家除了向同事傳授有關指揮塔的設計、建造、運作和維修保養的知識和經驗外，亦與同事分享了其他相關範疇的真知灼見，當中包括高效能源設計、運作上的過渡安排，以及數碼指揮塔技術的應用等。

Training on Design and Construction of Air Traffic Control Tower

In preparation for the design and construction of a new Air Traffic Control Tower (ATCT) in the Third-runway System Project, the division arranged overseas experts to conduct an in-house training course for colleagues from different divisions at the CAD headquarters during the period from 27 February to 3 March 2017. Apart from sharing knowledge and experience in ATCT design, construction, operations and maintenance, the overseas experts also shared insights in other related areas, including efficient energy design, operation transition arrangement, and application of digital tower technology, etc.



海外專家在民航處總部就指揮塔的設計提供內部培訓。
Overseas expert provided in-house ATCT design training at the CAD Headquarters.

衛星通訊、導航及監察/航管系統

為遵從國際民航組織的全球空中航行計劃，民航處已制定實施計劃，讓多項衛星通訊、導航及監察/航管系統和服務循序漸進地投入運作。當中，飛前放行指示雙向數據鏈路系統、電子飛行進程單系統和抵港航機排序系統在過去數年運作理想，為業界的營運帶來裨益。其他的最新發展概述如下：

Satellite-based CNS/ATM Systems

To comply with the ICAO Global Air Navigation Plan, CAD has formulated implementation plan and progressively put into operational use various satellite-based CNS/ATM systems and services. The Pre-Departure Clearance Two-way Datalink Service, the Electronic Flight Strip System and the Arrival Manager System have been in satisfactory operation for some years bringing operational benefits to aviation stakeholders. The latest development of the others is highlighted below:

(一) 航空電訊網、航空交通服務訊息處理系統和航空交通服務設施間數據通訊

按照國際民航組織亞太地區航空電訊網和航空交通服務訊息處理系統實施計劃，香港與澳門，以及香港與曼谷之間兩組新的電訊網和訊息處理系統已先後投入運作。香港現正與北京就新的電訊網和訊息處理系統進行進一步測試和試行，預期可於二零一八年投入運作。

航空交通服務設施間數據通訊已與新航管系統融合，成為該系統的其中一項功能，利用航空固定電訊網支援與三亞和台北以電子方式移交飛機，以加強飛行安全和促進運作效率。至於其他鄰近的空管中心，本處已於二零一六年四月與廣州和馬尼拉進行了初步的技術測試，並正在協調進一步測試和試行。

(二) 先進場面活動引導和控制系統

鑑於航空交通量持續增長及機場環境不斷改變，本處安排了系統供應商全面檢視先進場面活動引導和控制系統訊號的完整性和覆蓋範圍。根據檢視報告的建議，機場中場客運廊及機場北部已在二零一五年及二零一六年期間共增設八台外站單元機組，以增強系統訊號的覆蓋能力及提升系統容量，以配合即將進行的機場基建發展。此外，當局正考慮推展進一步的改善工程。

(三) 廣播式自動相關監察系統

在二零一六年十一月過渡至新航管系統後，廣播式自動相關監察已成為香港監察系統的主要組成部分，提供安全高效的航空交通管制服務。民航處根據國際民航組織的安全管理系統，採用分階段實施的方法管理風險，並確保廣播式自動相關監察能安全和順利地實施。自此，香港飛行情報區南部已採用該項技術保持飛機間距，以期逐步擴展技術的應用範圍，並計劃在所有相關安全風險評估工作圓滿結束後，於二零一七年下半年與新航管系統全面融合。

(i) Aeronautical Telecommunication Network, Air Traffic Services Message Handling System and Air Traffic Services Inter-facility Data Communication

In accordance with the ICAO Asia-Pacific Regional Aeronautical Telecommunication Network and Air Traffic Services Message Handling System Implementation Plan, two pairs of new circuits (i.e. Hong Kong – Macao and Hong Kong – Bangkok) have been commissioned for operational use. Further tests and trials on another new circuit with Beijing were being conducted with the planned operational use in 2018.

The Air Traffic Services Inter-facility Data Communication, being one of the functions integrated in the new ATMS, supports electronic transfer of aircraft with Sanya and Taipei to enhance flight safety and also operational efficiency through the Aeronautical Fixed Telecommunication Network. For other neighbouring ATC Centres, CAD has conducted initial technical tests with Guangzhou and Manila in April 2016. Further tests and trials are being coordinated.

(ii) Advanced Surface Movement Guidance and Control System

To cope with the continuous increase of air traffic and on-going changes in the airport environment, CAD has engaged the equipment supplier to conduct a comprehensive signal integrity and coverage study of the Advanced Surface Movement Guidance and Control System (A-SMGCS). In accordance with the recommendations of the study report, a total of eight A-SMGCS Remote Units had been installed at the Midfield Passenger Concourse and at the northern part of the airport during 2015 and 2016 to enhance the signal coverage performance and system capacity to cater for the forthcoming HKIA infrastructure development. Further improvements are being considered.

(iii) Automatic Dependent Surveillance-Broadcast System

With transition to the new ATMS in November 2016, Automatic Dependent Surveillance-Broadcast (ADS-B) has become an integral part of the Hong Kong's surveillance system for provision of safe and efficient air traffic control services. CAD has adopted a phased implementation approach, in accordance with the ICAO's Safety Management System, to manage the risks and ensure safe and smooth ADS-B implementation. Since then, ADS-B has been used for aircraft separation in the southern part of the Hong Kong Flight Information Region, with a plan to gradually expand for full integration with the new ATMS in the second half of 2017 after satisfactory completion of all the relevant safety risk assessments.

(四) 陸基增強系統

為了令採用全球衛星導航系統的飛機進場和着陸程序更為精確，民航處已就機場安裝陸基增強系統進行了初步的選址研究。本部結合了本處和地政總署設於全港各處的全球衛星導航系統監測站所收集到的實時數據，設立全港衛星數據庫。此外，本處自二零一三年起使用電離層閃爍監測系統，並通過國際民航組織電離層研究專責小組與周邊地區合作，共同研究電離層對亞太地區陸基增強系統性能所可能產生的影響，以及區內應用該系統所須採取的安全緩解措施。二零一六年九月，國際民航組織採納了電離層研究專責小組為亞太地區研發的陸基增強系統電離層威脅模型。

(五) 機場協同決策

民航處在二零一三年成功推出桌面版及手機版的機場協同決策互聯網平台，該平台一直獲航空業界大力支持，成績令人鼓舞。在這個卓有成效的基礎上，香港機場管理局已進一步增強和擴展機場協同決策計劃。民航處會繼續全力支持，並在技術和運作方面提供意見，以提升香港國際機場的運作效率。

航空交通安全電子設備人員的培訓及評核

國際民航組織自二零一一年公布《航空交通安全電子設備人員培訓手冊》（第7192號文件），支持「下一代航空專業人員」計劃後，在二零一六年就《空中航行服務程序—培訓》文件發布了數項修訂，在飛行員和空管人員以外，加入了電子設備人員的培訓規定。有關修訂推廣以技能為本的培訓發展模式，並就使用技能框架培養電子設備人員的建議，提供更詳盡的細節。此外，本部

(iv) Ground-Based Augmentation System

To augment the precision of aircraft approach and landing operations using the Global Navigation Satellite System (GNSS), CAD has conducted a preliminary siting study in preparation for installing a Ground-Based Augmentation System (GBAS) at HKIA. A territory-wide satellite database was established by combining the real time data collected by CAD's and Lands Department's GNSS monitoring stations located around the territory. Moreover, CAD has commenced using an Ionospheric Scintillation System since 2013, which enabled the collaboration with neighbouring areas through the ICAO Ionospheric Studies Task Force on studying the possible ionospheric effect on GBAS performance and the necessary safety mitigating measures for deploying GBAS in the Asia Pacific region. The ICAO has adopted the GBAS Ionospheric Threat Model for the region developed by the Task Force in September 2016.

(v) Airport Collaborative Decision Making

CAD successfully launched the Airport Collaborative Decision Making (A-CDM) platform in both desktop and mobile versions on the Internet back in 2013 with very encouraging feedback and support from the aviation industry. Building on the sound implementation of the CAD's A-CDM platform, the Airport Authority Hong Kong has further enhanced and extended the A-CDM programme. CAD would continue to fully support and provide advice on technical and operation aspects for enhancing the overall HKIA's operational efficiency.

Air Traffic Safety Electronics Personnel Training and Assessment

Further to the publication of the Air Traffic Safety Electronics Personnel (ATSEP) Training Manual Doc 7192 in 2011 for supporting the Next Generation of Aviation Professionals initiatives, ICAO has released several revisions of the Procedures for Air Navigation Services – Training in 2016 which included the training requirements for ATSEP in addition to pilots and air traffic controllers. These editions promote the development of competency-based training and recommend the use of a competency framework for training of electronics personnel with more details. In addition, a gap analysis was conducted against the new guidance document from

根據國際民航組織的新指引文件，就電子設備人員以技能為本的培訓及評核進行了差距分析。民航處會繼續留意及採納與電子設備人員有關的國際規定，進一步提升航空安全水平。

更換空管系統項目的第二期計劃

新空管中心於二零一六年十一月投入服務，標誌着更換空管系統項目的第一期工作已順利完成。本處隨即籌劃項目的第二期計劃，在空管大樓的舊空管中心和南指揮塔安裝新的空管設備。本處在二零一六年一月成立了空管大樓和南指揮塔翻新工作專責小組，成員包括民航處、建築署、機電工程署和香港天文台的代表，以及民航處的系統保養承包商，以督導各個項目的整體協調工作，當中包括屋宇翻新和維修工程項目、更換屋宇服務設施，以及安裝和測試新空管系統。

資訊科技管理

通過妥善實施各項新的資訊科技措施和「電子政府」策略，資訊科技管理組繼續支援各分部的日常運作。年內，該組完成了以下大型資訊科技項目，以加強資訊科技服務和支援：

(一) 二零一六年十月，資訊科技管理組成功通過由國際認可的認證機構進行的ISO 9001:2008品質管理重新認證審計。這是自二零一零年以來，該組第三次成功更新ISO 9001:2008的認證。

(二) 年內，資訊科技管理組設計和開發了一個具有文件控制、分發和管理功能的網絡應用系統，方便民航處各分部更有效地共用航空安全的相關文件。

ICAO regarding the ATSEP competency-based training and assessment. CAD will continuously monitor and adopt the relevant international requirements on ATSEP to enhance aviation safety.

Phase 2 Programme of ATC System Replacement Project

The commissioning of the new ATC Centre in November 2016 marked the successful completion of the Phase 1 work of the ATC System Replacement Project. CAD has proceeded with planning for the Phase 2 Programme of the project, in which new ATC equipment would be installed in the old ATC Centre and South Tower (S-TWR) at the Air Traffic Control Complex (ATCX). CAD has established the ATCX and S-TWR Refurbishments Task Force in January 2016, with members from CAD, Architectural Services Department, Electrical and Mechanical Services Department, Hong Kong Observatory and CAD's system maintenance contractor, to steer the overall coordination of various works items on building refurbishments and repairs, building services facilities replacement, and new ATC systems installation and testing, etc.

Information Technology Management

The Information Technology Management Unit (ITMU) continued to support the day-to-day operations of various divisions through effective implementation of new Information Technology (IT) initiatives and the e-Government strategy. During the year, the following major IT projects were completed for the betterment of IT service and support:

(i) In October 2016, ITMU successfully passed the ISO 9001:2008 quality management re-certification audit conducted by an internationally recognised certification body. This has been the third successful renewal of its ISO 9001:2008 certification since year 2010.

(ii) ITMU designed and developed a web application system with document control, distribution and management functions to facilitate more effective sharing of aviation safety related documents among various divisions in the department.