For discussion **FCR(2007-08)9**
on 11 May 2007

ITEM FOR FINANCE COMMITTEE

CAPITAL WORKS RESERVE FUND
HEAD 708 – CAPITAL SUBVENTIONS AND MAJOR SYSTEMS AND EQUIPMENT
Civil Aviation Department
New Subhead "Replacement of air traffic control system"

Members are invited to approve the creation of a new commitment of $1,565 million for replacing the air traffic control system of the Civil Aviation Department.

PROBLEM

The capacity and functionalities of the existing air traffic control (ATC) system of the Civil Aviation Department (CAD) will not be able to cope with the projected air traffic growth. The system is also approaching the end of its usable life by around 2012.

PROPOSAL

2. The Director-General of Civil Aviation, with the support of the Secretary for Economic Development and Labour, proposes to replace the ATC system at an estimated cost of $1,565 million.

JUSTIFICATION

3. One of the major functions of CAD is to provide ATC service to flights arriving at or departing from the Hong Kong International Airport (HKIA) and aircraft overflying the Hong Kong Flight Information Region (HKFIR) with a total area of 276 000 km^2. The ATC system, comprising advanced electronics systems, is an essential tool enabling air traffic controllers to provide safe, reliable, effective and efficient ATC service.

/Growing .....

Growing Air Traffic

4. Under the progressive liberalisation policy, Hong Kong's aviation sector has been growing rapidly. Since the opening of HKIA in 1998, annual aircraft movements at HKIA have grown by 72% to reach 280 000 movements in 2006, or a daily average of 768 movements, which exceed by 39% the 202 200 movements forecast for 2005 in the 1991 New Airport Master Plan. Over the same period, overflight traffic through HKFIR has also grown by 95% to reach 140 000 movements in 2006.

5. In the regional context, the Pearl River Delta (PRD) region is one of the fastest growing areas for air traffic. It is expected that the combined annual traffic at the five airports in the PRD region (Hong Kong, Guangzhou, Shenzhen, Macao and Zhuhai) will increase from the present 700 000 aircraft movements to 1 800 000 movements by 2020. In its latest long-term development plan, the Airport Authority (AA) envisions that HKIA would handle 490 000 movements a year by 2025, or a daily average of about 1 340 movements.

6. Other than the robust growth in air traffic, our ATC system has been subject to additional strain due to the high concentration of airports in the PRD region, which has created a congested airspace that reduces the efficiency of our air traffic management. The situation has been exacerbated by the equally significant growth of air traffic to/from the Macao airport, which takes up a substantial part of our ATC capacity as it relies heavily on ATC service provided by CAD.

Need to Replace the Existing ATC System

7. The existing ATC system has been in operation since the opening of HKIA in 1998 and will reach the end of its usable life by around 2012. For the following reasons, our ATC capacity will need to be enhanced as air traffic at HKIA continues to grow –

(a) some components of the existing system are already out of production and the system is being sustained through redeployment of existing parts where possible. This does not only limit further expansion of capacity, but also imposes constraints on maintenance;

(b) designed in the early 1990's, the existing system cannot support some of the functionalities common in state-of-the-art ATC systems, such as automatic display of essential flight data to controllers, traffic situation analysis, and calculation of optimal arrival sequence and landing times of aircraft. These technologies are particularly important for an efficient ATC service in a congested airspace; and

/(c) .....

(c) in terms of functionality and capacity, without the improvement envisaged, the existing system will gradually lag behind those used by other ATC authorities in our vicinity, such as Guangzhou, Shanghai, Beijing, Taiwan, Singapore and South Korea, many of which have been or are in the process of migrating to the latest generation of ATC systems. This inhibits inter-operability with other ATC systems (i.e. the exchange of operation-related data between systems), which is essential for strengthening inter-agency co-ordination to enhance ATC efficiency.

Anticipated Benefits of the New System

8. For the reasons set out above, we recommend replacing the existing ATC system by a completely new system that is on a par with the most advanced systems adopted globally. With much enhanced data transmission, processing and display power, the new system can provide up to twice the handling capacity of the existing system and will be able to support 490 000 aircraft movements in 2025 as forecast by AA. Not only can this strengthen our ability in providing better services to the public and the business community, it can also enhance Hong Kong's competitiveness in maintaining its status as an international and regional aviation hub.

9. The proposal of replacing the ATC system would ensure the continued provision of safe, reliable, efficient and effective ATC service in line with air traffic growth. This is crucial to strengthening Hong Kong's ability to capture the enormous growth opportunities ahead amidst keen competition posed by other neighbouring airports in the region. We estimate that consequential to increased flights permitted by the proposal, the increase in value added of air transport activities will reach $16.2 billion per annum in current market prices by 2020. In addition, there will be indirect positive impact on the trading, logistics and tourism sectors which rely heavily on the capacity and traffic of our world-class airport.

Development of CAD Headquarters

10. As a related project, we also propose to develop a new CAD headquarters cum ATC Centre on the Airport Island to house the new ATC system and the various divisions of the Department. We will separately seek the approval of the Finance Committee for the project during the course of 2007-08.

FINANCIAL IMPLICATIONS

Non-recurrent Cost

11. Based on the latest market information, the estimated non-recurrent cost of the proposal is $1,565 million, with the following breakdown –

		$ million
(a)	Equipment costs	987
(b)	Professional services	70
(c)	System installation and commissioning	352
(d)	Contingency	156
	Total	**1,565**

Encl. Brief functional descriptions of the individual components and cost breakdown are set out in the Enclosure.

12. On paragraph 11(a), the estimate of $987 million is for the acquisition of new ATC and training/simulator systems as well as initial spare parts.

13. On paragraph 11(b), the estimate of $70 million is for the engagement of the CAD's maintenance contractor to provide on-site support/assistance in the installation, testing and commissioning of the new ATC system.

14. On paragraph 11(c), the estimate of $352 million is for the expenses in relation to system delivery, installation, testing, operational and technical training on new equipment.

15. On paragraph 11(d), the estimate of $156 million represents an approximately 11% contingency on the items set out in paragraphs 11(a)-(c).

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16. The estimated cash flow requirement of the proposal is as follows –

Financial Year	$ million
2007-08	2
2008-09	13
2009-10	160
2010-11	220
2011-12	450
2012-13	440
2013-14	150
2014-15	80
2015-16	50
Total	**1,565**

Other Non-recurrent Cost

17. The implementation of the current proposal and the proposal of developing a new CAD headquarters on the Airport Island will necessitate the creation of one post of Assistant Director-General of Civil Aviation (ADGCA) (D2) and 21 posts of the Air Traffic Control Officer and Electronics Engineer grades up to 2012-13. The full-year staff cost involved is around $28 million per annum. The proposed ADGCA post was supported by the Establishment Subcommittee on 25 April 2007 and will be put to the Finance Committee for approval on 11 May.

Recurrent Cost

18. The additional recurrent expenditure arising from the proposal is estimated to be $56 million per annum in full year from 2015-16 onwards. A breakdown is provided below –

		$ million
(a)	Maintenance services	70
(b)	Specialised supplies	54
		124
(c)	Less: Annual savings	68
	Total	**56**

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19. On paragraph 18(a), the estimate of $70 million is for the maintenance of the new ATC system by the CAD's maintenance contractor. This covers the maintenance of an additional Centralised Fault Reporting Centre at the new ATC Centre as well as the additional technical services to be undertaken to cover the increased scale, complexity and functionalities of the new system.

20. On paragraph 18(b), the estimate of $54 million is for the purchase of specialised spare parts, tools and test equipment for the new ATC system.

21. On paragraph 18(c), the savings of $68 million represent the recurrent costs of the existing system which will be ploughed back to cover part of the recurrent costs of the new system.

Impact on Fees and Charges

22. Under the existing "user pays" principle, the amortised project cost[1] and the recurrent cost for providing ATC service will be recovered through the ATC service charges collected from AA (which in turn will take into account ATC service charges when determining the landing charges that it collects from the airline operators) and en-route navigation charges (for overflying aircraft without landing at HKIA) collected directly from airlines by the Government. The total annual ATC service charges collected from AA are estimated to increase from the existing level of $638 million to $845 million in 2013. However, since the number of flights landing at HKIA is expected to increase from 140 000 to 176 000 during the same period, it is likely that the cost per flight will only see a mild increase of less than $300, or about 6%[2] of the existing figure. Likewise, it is not envisaged that the en-route navigation charge, currently at $4.8 per nautical mile, will see any significant change arising from the proposal when the increased costs are expected to be cancelled out by the increased traffic.

/IMPLEMENTATION .....

[1] Inclusive of the cost of construction of the new CAD headquarters cum ATC Centre, estimated at $1,590 million.

[2] Assuming that AA will fully pass on any additional ATC service charges to the airlines. The cost per flight may be lowered after 2013 should the number of flights landing at HKIA increase further as projected by AA.

IMPLEMENTATION PLAN

23. We plan to implement the proposal according to the following schedule –

	Activity	Target completion date
(a)	Preparation and approval of tender documents for various components of the new ATC system	February 2010
(b)	Tender invitations for various components of the new ATC system	March 2010
(c)	Award of contracts for various components of the new ATC system	October 2010
(d)	Delivery of the new ATC system	July 2011
(e)	Installation and integration of the new ATC system for testing and evaluation	February 2012
(f)	Operational evaluation and controller training	December 2012
(g)	Transition to and commissioning of the new ATC system	December 2012
(h)	Delivery of backup ATC system	January 2014
(i)	Installation, integration and commissioning of the backup ATC system	January 2015

24. The existing equipment will be of little resale value and very few components can be recycled. Disposal of some of the components, such as some computer boards and monitors, may be of environmental concern. Relevant requirements and procedures will be followed in the disposal of these components. Other components will be disposed of in the normal manner.

PUBLIC CONSULTATION

25. We sought comments on the proposal from the aviation industry in a briefing on 18 January 2007, and consulted the Aviation Development Advisory Committee and the Legislative Council Panel on Economic Services on 2 and 26 February 2007 respectively. They in general supported the proposal.

Economic Development and Labour Bureau
May 2007

Functional Descriptions of Replacement Air Traffic Control System and Related Training/Simulator Systems

(A) Replacement Air Traffic Control (ATC) System[1]

Item	Equipment/system	Functional description	Estimated cost[2] ($ million)
1	Radar Data Processing and Display System/Flight Data Processing System (RDPDS/FDPS)	The RDPDS/FDPS is the heart of the ATC system. The RDPDS processes the radar data from various primary and secondary radars to present the aircraft position and its related information such as aircraft callsign, altitude, ground speed, aircraft category, etc. on the radar display. The information is used by air traffic controllers to control the approach/departure, terminal and en-route traffic. The FDPS processes the flight plan data from aeronautical messages and Repetitive Flight Plan Database, and prints out different flight progress strips (for arrivals, departures and overflights) automatically for use by air traffic controllers to update/monitor the aircraft flight profile such as flight route, estimated time of departure/arrival, flight level, expected times at reporting points, cruising speed, etc.	675

[1] Each component indicated in the table includes the operational and the backup equipment, which will be procured in the same tender exercise. The backup equipment will have half the capacity of the operational ones.

[2] Inclusive of costs of equipment, professional services, and system installation and commissioning.

Item	Equipment/system	Functional description	Estimated cost[2] ($ million)
		New features, including those specified under the Satellite-based Communications, Navigation, Surveillance/Air Traffic Management (CNS/ATM) Systems such as Automatic Dependent Surveillance-Broadcast, conflict alerts, Minimum Safe Altitude Warning, Arrival Metering and Sequencing System, Flow Control Management, Air Traffic Services (ATS) Inter-facility Data Communications, Electronic Flight Progress Strips, Trajectory Conformance Monitoring, etc., will be incorporated to further enhance flight safety and operational efficiency, and inter-operability with ATC systems in neighbouring airports.	
2	Speech Processing Equipment (SPE)	The SPE is an integrated system capable of performing digital voice switching functions for the air-to-ground and ground-to-ground voice communications with ATC operators through various means such as radio telephony, intercom, inter-area speech circuits, hot line/direct line telephones, Private Automatic Branch Exchange (PABX) telephones and Private Automatic Exchange (PAX) telephones. The SPE also supports various user groups with separate and common communication facilities, and provides intra- and inter-group communications. The new SPE will include Very High Frequency Data Link Applications under the CNS/ATM Systems.	165

Item	Equipment/system	Functional description	Estimated cost[2] ($ million)
3	Aeronautical Information Database	The system provides Notice to Airman (NOTAM)/Preflight Information Bulletin (PIB)/electronic Aeronautical Information Publication processing. It maintains an on-line database of all standing NOTAMs, expired NOTAMs of the last three years and Jeppessen airspace data, and provides the facility for production of aeronautical/safeguarding charts. The system compiles daily PIBs. It supports compilation of ad hoc PIBs as requested on-line by the airlines. It also provides alert to the ATC supervisor upon detection of airspace restrictions and runway closure information from the received NOTAMs, and supports real-time retrieval of such NOTAMs by ATC and relevant authorities.	120
4	ATS Message Handling System and Aeronautical Telecommunication Network	These are the new and standard systems under the CNS/ATM Systems to replace the existing Automatic Message Switching System for enhanced support/distribution of aeronautical and meteorological messages (including graphics) among ATC authorities, meteorological offices and airlines. Delivery of messages through the new systems will be faster, more secure and reliable.	75

Item	Equipment/system	Functional description	Estimated cost[2] ($ million)
5	Cable/Microwave Link Network	The system is used to convey the air-to-ground voice communications, speeches and radar data/signals, and to relay the remote controls and status indications of the communications, navigational aids and radar equipment at various on-airport and off-airport stations to the new ATC Centre, and between the new ATC Centre, Aerodrome Control Tower and Backup ATC Centre/Tower. It also includes the backup network for utmost reliability and availability. The microwave link network consists of low and medium capacity digital links and wide band video links. The cable network consists of a copper cable and broadband fibre optic network. New features, including transmission of digital aeronautical data as required under the CNS/ATM Systems, will be provided.	120
6	Centralised Monitoring and Control System	It is used in the Civil Aviation Department's (CAD's) Centralised Fault Reporting/Maintenance Watch-keeping Centres to monitor the status and alarm indications of the ATC system and to exercise remote control of the whole system, including their sub-systems and ancillary facilities (e.g. status for power supply, air-conditioning systems, fire fighting, access control/closed circuit television systems, etc.) so as to enable a real-time and efficient equipment monitoring and control by the 24-hour watch-keeping team.	15

Item	Equipment/system	Functional description	Estimated cost[2] ($ million)
7	Very Small Aperture Terminal (VSAT)	The VSAT is a satellite communication system to convey ATC voice messages and radar data between Hong Kong and various operational stations of the Civil Aviation Administration of China, including Xisha, Haikou, Guangzhou and Beijing.	15
8	Voice Recording/Playback System (VRS)	The VRS is a multi-channel 24-hour voice recording system to record air-to-ground and ground-to-ground voice signals over radio communication links, intercom and telephones used by the ATC operators to facilitate aircraft incident/accident investigation. This is a standard International Civil Aviation Organization requirement.	23
9	Telephone System (PABX/PAX)	The PABX telephone system is a digital voice switching system for internal/external voice communications among ATC operators and other concerned parties via the public telephone network. The PAX telephone system is a digital voice switching system for internal voice communications among ATC operators via a private network.	6
10	Secondary Surveillance Radar (SSR) Situation Display System	The system provides a separate and stand-alone SSR situation display facility for reference by ATC operators as well as ATS/CAD management.	3

Item	Equipment/system	Functional description	Estimated cost[2] ($ million)
11	ATC Radio Telephony (R/T) Workload Monitoring System	The system monitors and calculates all R/T communications times for selected air traffic controller positions for comparison against pre-set threshold. The resulting data can be used to assess the prevailing workload situation of air traffic controllers to avoid possible overload situations.	3
12	Uninterruptible Power Supply System	The system reduces surges and fluctuations in the incoming mains supply to provide a reliable, steady and clean power supply to all the components of the ATC system and provides backup power for up to 30 minutes during mains supply interruptions.	8
13	Master Clock System	The system provides a standard reference time signal for the synchronisation of all the components of the ATC system and the time display units in various operations centres and ATC control positions.	5
14	Radar Data Formatter	The system converts radar data from one format to another acceptable by the new RDPDS.	5

Item	Equipment/system	Functional description	Estimated cost[2] ($ million)
15	Other ancillary systems/ facilities (e.g. operating consoles, Information System Data Distribution Network, QNH[3] Alarm System, interface systems with the Airport Authority and Hong Kong Observatory, Meteorological Display system, Specialised Controller Chairs, Cosmicheskaya Sistyema Poiska Avariynich Sudov-Search and Rescue Satellite-Aided Tracking Workstations, ATC Fast-Time Simulation System, etc.)	These are ancillary systems/facilities that need to be provided so as to make the new ATC Centre fully equipped for functional use.	112
		Sub-total	**1,350**

[3] QNH is an air pressure setting used to set the airborne barometric altimeter to provide the accurate altitude reading of aircraft above mean sea level.

(B) Replacement Training/Simulator Systems

Item	Equipment/system	Functional description	Estimated cost[2] ($ million)
1	Radar Simulator for RDPDS/FDPS	The Radar Simulator for RDPDS/FDPS is a replica of the operational RDPDS/FDPS and is used for the training of air traffic controllers and evaluation of ATC procedures under different traffic scenarios.	26
2	Tower Simulator	It is used for the training of air traffic controllers on aerodrome control. The simulator uses suitable imaging technology to simulate different traffic (for both aircraft and vehicles) and airfield environments, during day or night, and under good or bad weather conditions.	28
3	Computer-Based Training System	The system employs networked workstations and provides a self-learning or refresher training facility for air traffic controllers. The training scope covers aviation English training and operational training for various ATC system and procedures.	5
		Sub-total	**59**
		Grand total ((A)+(B))	**1,409**
