For discussion
on 24 April 2020

FCR(2020-21)4

ITEM FOR FINANCE COMMITTEE

CAPITAL WORKS RESERVE FUND
HEAD 708 – CAPITAL SUBVENTIONS AND MAJOR SYSTEMS AND EQUIPMENT
Hong Kong Observatory
New Subhead "Provision of aviation meteorological systems to support the Three-Runway System at Hong Kong International Airport"

Members are invited to approve the creation of a new commitment of $271.9 million for the provision of aviation meteorological systems to support the Three-Runway System at Hong Kong International Airport.

PROBLEM

To support the implementation of the Three-Runway System (3RS) at Hong Kong International Airport (HKIA), the Hong Kong Observatory (HKO) needs to acquire new aviation meteorological equipment and enhance its existing aviation meteorological systems and equipment to provide the necessary aviation weather services.

PROPOSAL

2. The Director of HKO, with the support of the Secretary for Transport and Housing, proposes to create a new commitment of $271.9 million to acquire new aviation meteorological equipment and enhance its existing aviation meteorological systems and equipment, which will underpin the necessary aviation weather services in support of the 3RS at HKIA. The proposal is also supported by the Commerce and Economic Development Bureau as HKO's housekeeping bureau.

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JUSTIFICATION

3. Within the framework of the International Civil Aviation Organization (ICAO), HKO is a designated meteorological authority and is responsible for the provision of weather services for international air navigation in Hong Kong. It is responsible for acquiring and enhancing the aviation meteorological systems and facilities to support the 3RS.

4. At the meeting on 18 July 2018, the Finance Committee approved the upgrading of the Public Works Programme project 3070GI – "Provision of Aviation Weather Services Facilities to support the Three-Runway System at the Hong Kong International Airport" to Category A. That is part of the first batch of government facilities to support the 3RS, including a meteorological garden, equipment rooms, equipment sites, as well as underground cable duct system linking the above facilities with various existing aviation weather services systems and facilities and HKO office at the existing Air Traffic Control (ATC) towers and the new ATC tower.

5. As foreshadowed in the papers to the Legislative Council (LegCo) Panel on Economic Development (LC Paper No. CB(4)1110/17-18(03)) and Public Works Subcommittee (PWSC(2018-19)25), apart from the construction of these facilities, HKO will also require new systems and equipment for providing the necessary aviation weather services to support the 3RS, and funding approval for such systems and equipment would be sought separately. The scope of the current proposal covers the following four areas, as further outlined for each in paragraphs 7 to 13 below –

(a) provision of new on-airport meteorological equipment to support the operation of the third runway;

(b) provision of new on-airport meteorological equipment to support the operation of the new centre runway[1];

(c) provision of new off-airport meteorological equipment (including a new Terminal Doppler Weather Radar (TDWR) for detection of windshear, and new equipment to support visibility forecasting); and

(d) enhancement of existing meteorological systems and equipment to cater for the 3RS.

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[1] After the commissioning of the third runway, the existing North Runway will be closed for about two years for reconfiguration into the new centre runway.

6. Details of the aviation meteorological systems and equipment concerned are set out at the Enclosure.

Encl.

Provision of new on-airport meteorological equipment to support the operation of the third runway

7. In accordance with the International Standards and Recommended Practices of ICAO[2], each runway has to be equipped with its own meteorological equipment to monitor the atmospheric conditions at specific locations of the runway for safeguarding the safety of flights taking off and landing. Such information, including surface wind speed and direction, runway visual range (RVR), visibility and height of cloud base, will be measured using equipment such as anemometers, RVR transmissometers, forward scatterers and ceilometers respectively.

8. Besides, for the safe and efficient operation of the third runway, windshear alerting, wake vortex and lightning sensing equipment commensurate with the standards for the existing runways are required for the third runway. In addition, considering the distance of the third runway from the existing meteorological facilities, it is necessary for HKO to acquire a set of meteorological equipment at the new meteorological garden and a new wind profiler for measuring the surface and upper air conditions near the third runway.

Provision of new on-airport meteorological equipment to support the operation of the new centre runway

9. The commissioning of the third runway is scheduled for 2022, after which the existing North Runway will be closed for about two years for reconfiguration into the new centre runway. Upon reconfiguration of the runway, the meteorological equipment at the eastern and western ends of the existing North Runway would have to be relocated. While HKO would make use of existing meteorological equipment for the new centre runway as far as possible, new meteorological equipment such as two new sets of anemometers would be required for collecting additional climatological information at the relocated sites.

Provision of new off-airport meteorological equipment

10. Windshear is a hazardous weather phenomenon that has brought about aircraft accidents around the world. Issuance of windshear alerts in good time is of paramount importance to ensure aviation safety. HKO currently makes

/use …..

[2] ICAO Annex 3 – Meteorological Service for International Air Navigation.

use of a TDWR installed at Brothers Point TDWR station for detection and alerting of windshear and microburst in rainy conditions. The existing TDWR at Tai Lam Chung TDWR station (installed in 1996) has been serving as a back-up since 2015 but would hardly be able to function (not even as a back-up) shortly[3]. To cope with the air traffic growth upon the commissioning of the 3RS, it is necessary for HKO to acquire and install a new TDWR at the Tai Lam Chung TDWR station for windshear and microburst detection for HKIA.

11. Upon commissioning of the new TDWR, the two TDWRs will work in tandem to ensure uninterrupted, timely and accurate detection and alerting of windshear. At times when one of the TDWRs is not serviceable due to reasons such as maintenance or repair, HKO can rely on the other TDWR to maintain the windshear alerting services. This arrangement can also ensure a smoother transition upon replacement of one of the TDWRs in future.

12. To ensure sufficient lead time in the forecast of visibility drop, HKO also needs to install new equipment to support visibility forecasting at other off-airport locations, such as Lung Kwu Chau and Hong Kong-Zhuhai-Macao Bridge.

Enhancement of existing meteorological systems and equipment to cater for the 3RS

13. Apart from acquiring new equipment to support the 3RS, HKO also needs to enhance its existing systems and equipment, so as to cope with the increased scale of its operation in future. Enhancement of the existing meteorological systems, such as the Aerodrome Meteorological Observing System and Windshear and Turbulence Warning System, is necessary to process the additional data from the new equipment and provide the required warning and alerting service for the 3RS. Moreover, extension of these existing systems is required to support the new Airport Meteorological Office at the new ATC tower.

FINANCIAL IMPLICATIONS

Capital Expenditure

14. The proposal is estimated to incur a capital expenditure of $271.9 million, with the following breakdown –

/(a) …..

[3] The existing TDWR at Tai Lam Chung was installed over 20 years ago. As this is significantly longer than its normal serviceable life of 15 years, a number of its critical spare parts have been out of production for some years. While it has been serving as a back-up since the commissioning of the newer Brothers Point TDWR in 2015, soon it will hardly be able to function (not even serve as a back-up) as HKO will no longer be able to upkeep it after depleting stock of the critical spare parts.

		$ million
(a)	Provision of new on-airport meteorological equipment to support the operation of the third runway	76.4
(b)	Provision of new on-airport meteorological equipment to support the operation of new centre runway	9.7
(c)	Provision of new off-airport meteorological equipment	123.0
(d)	Enhancement of existing meteorological systems and equipment to cater for the 3RS	38.1
(e)	Contingency	24.7
Total		**271.9**

15. On paragraphs 14 (a) to 14 (c), the estimates will cover the cost of acquiring the new meteorological equipment and its peripherals, including initial spare parts, consumables and test equipment, as well as the cost for delivery, installation, testing, commissioning, documentation and associated technical training.

16. On paragraph 14 (d), the estimate of $38.1 million will cover the cost of enhancing the existing meteorological systems and equipment to cater for the 3RS, including acquiring new data reception/processing hardware and networking equipment, upgrading software to handle data to support the 3RS, as well as hiring contract staff for in-house software development.

17. On paragraph 14 (e), the estimate of $24.7 million represents an approximately 10% contingency on the items set out in paragraphs 14 (a) to 14 (d) above.

18. The cashflow projection of the capital expenditure is as follows –

Financial Year	**$ million**
2020-21	14.1
2021-22	105.0
2022-23	84.3
2023-24	23.6
2024-25 and onwards	44.9
Total	**271.9**

/**Other** …..

Other Non-recurrent Expenditure

19. The proposal will entail a total non-recurrent staff cost of $7.6 million for the implementation of the project. Such cost will be absorbed by HKO using existing resources.

Recurrent Expenditure

20. It is estimated that the proposal will entail an additional annual recurrent expenditure of $1.1 million in 2021-22, rising to $14.5 million in 2024- 25 and onwards, with breakdown as follows –

	Financial Year	**2021-22 ($ million)**	**2022-23 ($ million)**	**2023-24 ($ million)**	**2024-25 & onwards ($ million)**
(a)	Light and power	-	-	-	0.4
(b)	Rental of communication links	-	0.1	0.1	0.1
(c)	Specialised spare parts and consumables	-	6.2	6.2	8.0
(d)	Maintenance and other professional services	1.1	5.2	5.4	6.0
	Total	**1.1**	**11.5**	**11.7**	**14.5**

21. On paragraphs 20 (a) to 20 (d), the estimated recurrent expenditure is for the necessary light and power, communication links, specialised spare parts and consumables, and maintenance and other professional services for maintaining the operation of the systems and equipment.

22. According to the “user pays” principle, the costs for HKO to provide the relevant aviation weather services will be fully recovered from the Airport Authority Hong Kong (AAHK) through services charges for aviation weather services for aircraft taking off/landing at the HKIA after the first batch of systems is installed and has commenced operation (i.e. from 2021-22 onwards). The additional recurrent cost and depreciation cost arising from the project will be taken into account in setting the aviation weather services charges for AAHK in future.

/IMPLEMENTATION …..

IMPLEMENTATION PLAN

23. Subject to funding approval, we plan to commence the project immediately. HKO will procure the systems and equipment in accordance with the standard procurement procedures of the Government and take into account the latest technological developments during the process. The project will be completed in phases, with the required systems and equipment ready to support the commissioning of the third runway in 2022 and the entire 3RS by end 2024.

24. The progress of implementation will be subject to a number of factors such as completion of the new ATC tower, on-airport and off-airport equipment shelters. It also involves multiple contracts which entail careful planning of interface issues. HKO will work closely with the Architectural Services Department, AAHK, building/construction contractors and systems suppliers to closely manage the progress and ensure seamless cooperation.

PUBLIC CONSULTATION

25. HKO has consulted the aviation users through the Liaison Group on Aviation Weather Services and the Windshear and High Impact Weather Panel, comprising representatives from AAHK, pilots and airlines, on the relevant meteorological facilities and systems in support of the 3RS. They are supportive of HKO's proposal. We also consulted the LegCo Panel on Economic Development on 10 December 2019 on the second batch of government facilities to support the 3RS, including the systems and equipment required by HKO as detailed in this paper. The Panel supported the submission of the funding proposal to the Finance Committee.

Transport and Housing Bureau
Hong Kong Observatory
April 2020

Details of the proposed aviation meteorological systems to support the Three-Runway System (the 3RS) at Hong Kong International Airport (HKIA)

(a) Provision of new on-airport meteorological equipment to support the operation of the third runway

Item	Equipment/Systems	Details
1	Meteorological equipment near the third runway	To comply with the Standards and Recommended Practices of the International Civil Aviation Organization, a suite of meteorological equipment is required for safeguarding the safety of flights taking off and landing by monitoring the atmospheric conditions at specific locations of the runway. Such equipment for the third runway includes anemometers (for measuring winds), Runway Visual Range (RVR) transmissometers (for assessing RVR), forward scatterers (for measuring visibility) and ceilometers (for measuring height of cloud base).
2	LIght Detection And Ranging (LIDAR) systems	A LIDAR system is a specialised equipment to detect windshear when there is no rainfall. Two LIDAR systems are required for the third runway for mutual backup.
3	Short-range LIDARs	A short-range LIDAR is a specialised equipment to detect wake vortex generated by aircraft when there is no rainfall. Two short-range LIDARs are required, one for monitoring wake vortex dissipation at the eastern end and the other at the western end of the third runway.

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Item	Equipment/Systems	Details
4	Short-range Doppler Weather Radars	A short-range Doppler weather radar is a specialised equipment to detect wake vortex generated by aircraft when there is rainfall. Two short-range Doppler weather radars are required, one for monitoring wake vortex dissipation at the eastern end and the other at the western end of the third runway.
5	Lightning sensing equipment	Two sets of lightning sensing equipment are required at the eastern and western ends of the third runway for monitoring lightning activities of the third runway and its vicinity.
6	Meteorological equipment at the new meteorological garden	A suite of meteorological equipment including pressure sensors, temperature and humidity sensors and raingauges is required at the new meteorological garden to measure the surface weather conditions near the third runway.
7	Wind profiler	A wind profiler is required for monitoring winds at higher altitudes of the third runway.
8	Weather cameras	Weather cameras are required to support the observation of weather conditions along the third runway.

(b) Provision of new on-airport meteorological equipment to support the operation of the new centre runway

Item	Equipment/Systems	Details
9	Meteorological equipment near the new centre runway	A suite of meteorological equipment, including anemometer, RVR transmissometer, forward scatterer and ceilometer, are currently installed at the eastern and western ends of the existing North Runway. To avoid any interference with the Civil Aviation Department's (CAD) air navigation

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Item	Equipment/Systems	Details
		service equipment to be relocated for the new centre runway, the meteorological equipment at eastern and western ends of the existing North Runway would have to be relocated as well. Additional equipment is required at relocated sites, such as two new sets of anemometers for collecting additional climatological information.

(c) Provision of new off-airport meteorological equipment

Item	Equipment/Systems	Details
10	Terminal Doppler Weather Radar (TDWR)	TDWR is a specialised equipment for detection of windshear and microburst in rainy conditions. A new TDWR is required to ensure uninterrupted provision of windshear and microburst alerting services to cope with the air traffic growth upon the commissioning of the 3RS. It will be installed at the Tai Lam Chung TDWR station.
11	Equipment to support visibility forecasting	Equipment to support visibility forecasting includes forward scatterer and weather cameras, etc. Hong Kong Observatory plans to install the equipment at off-airport locations (such as Lung Kwu Chau and Hong Kong-Zhuhai-Macao Bridge) for monitoring the visibility to the north and west.

/**(d)** …..

(d) Enhancement of existing meteorological systems and equipment to cater for the 3RS

Item	Equipment/Systems	Details
12	Aerodrome Meteorological Observing System (AMOS)	AMOS is a system for observing weather conditions along airport runways and neighbouring areas. Enhancement of the AMOS is required for interfacing with new meteorological equipment supporting the new centre runway and the third runway.
13	Windshear and Turbulence Warning System (WTWS)	The WTWS integrates data from a host of meteorological sensors including TDWR, LIDAR, AMOS and wind profilers, and provides timely alerts (such as those related to windshear and turbulence) for landing and departure areas of HKIA. The proposed enhancement covers the integration of data from the new anemometers, LIDARs, wind profiler and TDWR, and the provision of alerting services for the 3RS.
14	Airport Thunderstorm and Lightning Alerting System (ATLAS)	ATLAS is a system which provides lightning alerts to ground staff working outdoors at the airport. Enhancement is required to enable integration of data from new lightning sensing equipment and extend its coverage to additional areas.
15	Aviation Thunderstorm Nowcasting System (ATNS)	ATNS is a nowcasting system to provide rapidly-updated short-term forecast of convective weather in arrival and departure corridors. Enhancement is required to extend the coverage of the system to the arrival and departure corridors for the 3RS.

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Item	Equipment/Systems	Details
16	Meteorological Data Processing System (METPS)	METPS is a computing system for acquisition, processing and distribution of weather information to support the operation of HKIA. It interfaces with the air navigation service equipment of the CAD and provides weather information to airlines and flight crew. Enhancement of the METPS is required to process the additional weather information and to cope with the higher demand on the system capacity arising from the 3RS.
17	Enhancement to the existing TDWR at Brothers Point	The existing TDWR at Brothers Point provides alerts for the existing two runways and has to be enhanced to provide alert for the third runway. Additional workstations and associated software for the existing TDWR are also required for use in the new Airport Meteorological Office (AMO) to support the operation for the 3RS.
18	Meteorological satellite and weather radar processing and display workstations	These are workstations for processing and displaying information from various meteorological satellite and weather radars. Additional workstations and associated software licence are required for use in the new AMO.
19	Other hardware, software, communication facilities, networking equipment and equipment to facilitate integration with new air navigation service equipment of CAD and the new AMO	Additional hardware, software, communication facilities, networking and other equipment are required for development, generation and display of aviation weather information from various meteorological facilities, and for supporting integration with new air navigation service equipment of CAD, new AMO and existing meteorological facilities.
