For discussion
on 25 June 2021

FCR(2021-22)38

ITEM FOR FINANCE COMMITTEE

CAPITAL WORKS RESERVE FUND
HEAD 708 – CAPITAL SUBVENTIONS AND MAJOR SYSTEMS AND EQUIPMENT
Hong Kong Observatory
New Subhead "Replacement of the long-range Light Detection and Ranging Systems of existing runways"
New Subhead "Procurement of aircraft wake turbulence detection equipment for the existing runways of the Hong Kong International Airport"

Members are invited to approve the creation of the following two new commitments for the Hong Kong Observatory –

(a) $64.2 million for the replacement of the long-range Light Detection and Ranging Systems of existing runways; and

(b) $37.8 million for the procurement of aircraft wake turbulence detection equipment for the existing runways of the Hong Kong International Airport.

PROBLEM

The long-range Light Detection and Ranging (LIDAR) Systems of the Hong Kong Observatory (HKO) at the existing North and South Runways of the Hong Kong International Airport (HKIA) are aging and need to be replaced. Also, there is a lack of aircraft wake turbulence detection equipment at the existing runways. It is essential to procure such equipment to enhance aviation safety and support HKIA's future development.

/PROPOSAL …..

PROPOSAL

2. The Director of HKO, with the support of the Secretary for Commerce and Economic Development, proposes to create two new commitments of $64.2 million and $37.8 million for the replacement of long-range LIDAR Systems and the procurement of aircraft wake turbulence detection equipment for the existing North and South Runways of HKIA respectively, so as to sustain and enhance aviation safety and support HKIA's future development.

JUSTIFICATION

3. Aviation safety is critical to the development of Hong Kong as an international aviation hub. As the designated meteorological authority in Hong Kong under the framework of the International Civil Aviation Organization, HKO provides weather services for international air navigation to ensure safe flight operations. To this end, HKO manages a range of aviation meteorological systems and facilities, and regularly replaces or upgrades them.

Replacement of long-range LIDAR Systems

4. Windshear is a hazardous weather phenomenon which has brought about aircraft accidents around the world. It is caused by a sudden change in wind direction or strength, resulting in a change in lift on aircrafts. When encountered close to the ground during take-off or landing, windshear could impact the control of aircrafts and lead to serious accidents. Timely windshear alerts are thus of paramount importance to aviation safety.

5. Windshear under non-rainy conditions are detected by long-range LIDAR Systems[1]. Currently, two long-range LIDAR Systems are installed at the existing North and South Runways[2] and backup each other. These long-range LIDAR Systems were commissioned in early 2016. While the typical serviceable life of the long-range LIDAR Systems is about ten years, the fine sand and dust blown from the nearby work sites of the Three-Runway System construction works have accelerated the deterioration of the bearings, gears and optical amplifiers of

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[1] Windshear under rainy conditions are detected by Terminal Doppler Weather Radars.

[2] The Legislative Council (LegCo) Finance Committee (FC) approved funding for installing similar long-range LIDAR Systems at the Third Runway in June 2020 (please refer to FC Paper FCR(2020-21)4). They could not serve the existing North and South Runways at the same time because the Third Runway, whilst parallel to the existing North and South Runways, is staggered to the west due to terrain.

the LIDAR Systems, thus affecting the equipment's pointing accuracy and performance. While HKO has stepped up cleaning and preventive maintenance of the existing LIDAR Systems and will continuously monitor their performance, HKO expects that the existing LIDAR Systems will need to be replaced by around end 2024 when the performance and reliability of the LIDAR Systems can no longer effectively support windshear alert services. The new LIDAR Systems will adopt the latest technologies, which would also help improve the quality of meteorological data collected by HKO.

Procurement of aircraft wake turbulence detection equipment

6. Wake turbulence is caused by a pair of intense vortices generated behind an aircraft in motion. When encountered in full strength by a following aircraft, wake turbulence may cause severe rolling motions and pose a threat to aviation safety. As the vortices will dissipate or be blown away from the flight path by background winds after some time, encountering of wake turbulence can be avoided by maintaining a safe distance between the leading and following aircrafts during take-off, en-route and landing (namely wake turbulence separation minima). A smaller wake turbulence separation minima may help increase the throughput of runways. Specialised short-range Doppler weather radars (SRDWRs) and short-range LIDAR (SRL) Systems are used for monitoring wake turbulence under rainy and non-rainy conditions respectively.

7. At present, HKO has not installed any SRDWRs and SRL Systems for the existing runways for wake turbulence monitoring[3]. To enable the provision of new wake turbulence detection services, HKO needs to procure two sets of new SRDWRs and SRL Systems, i.e. one set[4] each for the existing North and South Runways. Coupled with forecasts from HKO's Airport Meteorological Office, such new services will enable HKO to better support HKIA's future efforts in implementing weather-dependent wake turbulence separation minima standards, so as to manage air traffic demand and airport capacity more effectively.

IMPLEMENTATION DETAILS

8. HKO will be responsible for the implementation and management of the project, procurement of the required hardware and professional services, and development of the necessary software. Subject to funding approval, HKO plans to procure the replacement and new equipment through open tender and will take

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[3] The FC approved funding for installing similar SRDWRs and SRL Systems at the Third Runway in June 2020 (please refer to FC Paper FCR(2020-21)4). They could not serve the existing North and South Runways at the same time because the Third Runway, whilst parallel to the existing North and South Runways, is staggered to the west due to terrain.

[4] One set of SRDWRs and SRL Systems is comprised of two SRDWRs and two SRL Systems.

into account the latest technological developments during the process. HKO will work closely with the Civil Aviation Department and the Airport Authority Hong Kong (AAHK) in implementing weather-dependent wake turbulence separation minima standards.

FINANCIAL IMPLICATIONS

9. The estimated costs for replacing the long-range LIDAR Systems and procuring the SRDWRs and SRL Systems are as follows –

	Replacement of long-range LIDAR Systems ($'000)	**Procurement of SRDWRs and SRL Systems ($'000)**
Non-recurrent expenditure	64,200	37,800
Recurrent expenditure per annum	5,000 (full year effect from 2025-26)	1,200 (full year effect from 2025-26)

Replacement of long-range LIDAR Systems

Non-recurrent Expenditure

10. The estimated non-recurrent expenditure of replacing the long-range LIDAR Systems is broken down as follows –

	Financial Year	**2021-22 $'000**	**2022-23 $'000**	**2023-24 $'000**	**2024-25 $'000**	**2025-26 $'000**	**Total $'000**
(a)	Site surveying and preparation	90	-	-	10	-	100
(b)	Hardware and installation service	-	-	-	51,900	5,300	57,200
(c)	Software development	-	-	-	550	550	1,100
	Sub-total	90	-	-	52,460	5,850	58,400
(d)	Contingency	9	-	-	5,240	551	5,800
	Total	**99**	**-**	**-**	**57,700**	**6,401**	**64,200**

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11. On paragraph 10(a), the estimate of $0.1 million will cover the cost of site surveying and preparation.

12. On paragraph 10(b), the estimate of $57.2 million will cover the cost of acquiring the long-range LIDAR Systems and associated supplies, including initial spare parts, consumables and test equipment, and the relevant installation service.

13. On paragraph 10(c), the estimate of $1.1 million will cover the cost of contract staff for software development.

14. On paragraph 10(d), the estimate of $5.8 million represents an approximately 10% contingency on the items set out in paragraphs 10(a) to (c) above.

Recurrent Expenditure

15. It is estimated that operating the replaced long-range LIDAR Systems will entail an annual recurrent expenditure of $3.9 million in 2024-25, rising to $5.0 million per annum upon full implementation in 2025-26, with breakdown as follows –

	Financial Year	**2023-24** **$'000**	**2024-25** **$'000**	**2025-26 and onwards** **$'000**
(a)	Light and power	-	100	300
(b)	Maintenance service	-	-	500
(c)	Spare parts	-	3,400	3,400
(d)	Consumables	-	400	800
	Total	**-**	**3,900**	**5,000**

16. On paragraphs 15(a) to (d), the estimated recurrent expenditure is for the necessary light and power, maintenance service, spare parts and consumables for operating the long-range LIDAR Systems. Compared with the recurrent expenditure of around $2.4 million per annum for operating the existing long-range LIDAR Systems, operating the new long-range LIDAR Systems will cost some $2.6 million more, mainly due to the higher cost of spare parts. The costs will be fully recovered from users as detailed in paragraph 24 below.

/**Procurement** …..

Procurement of SRDWRs and SRL Systems

Non-recurrent Expenditure

17. The estimated non-recurrent expenditure of procuring the SRDWRs and SRL Systems is broken down as follows –

	Financial Year	**2021-22 $'000**	**2022-23 $'000**	**2023-24 $'000**	**2024-25 $'000**	**2025-26 $'000**	**Total $'000**
(a)	Site surveying and preparation	90	10	-	-	-	100
(b)	Hardware and installation service	-	1,900	4,200	23,650	3,450	33,200
(c)	Software development	-	-	550	550	-	1,100
	Sub-total	90	1,910	4,750	24,200	3,450	34,400
(d)	Contingency	9	191	450	2,400	350	3,400
	Total	**99**	**2,101**	**5,200**	**26,600**	**3,800**	**37,800**

18. On paragraph 17(a), the estimate of $0.1 million will cover the cost of site surveying and preparation.

19. On paragraph 17(b), the estimate of $33.2 million will cover the cost of acquiring the SRDWRs and SRL Systems and associated supplies, including networking equipment, initial spare parts, consumables and test equipment, and the relevant installation service.

20. On paragraph 17(c), the estimate of $1.1 million will cover the cost of contract staff for software development.

21. On paragraph 17(d), the estimate of $3.4 million represents an approximately 10% contingency on the items set out in paragraphs 17(a) to (c) above.

/***Recurrent*** …..

Recurrent Expenditure

22. It is estimated that operating the SRDWRs and SRL Systems will entail an annual recurrent expenditure of $0.3 million in 2023-24, rising to $1.2 million per annum upon full implementation in 2025-26, with breakdown as follows –

	Financial Year	2023-24 $'000	2024-25 $'000	2025-26 and onwards $'000
(a)	Light and power	100	200	200
(b)	Maintenance service	-	400	800
(c)	Spare parts	100	100	100
(d)	Consumables	100	100	100
	Total	**300**	**800**	**1,200**

23. On paragraphs 22(a) to (d), the estimated recurrent expenditure is for the necessary light and power, maintenance service, spare parts and consumables for operating the SRDWRs and SRL Systems.

Cost Recovery

24. According to the "user pays" principle, the costs (i.e. the non-recurrent and recurrent expenditure incurred from procuring and operating the equipment) for HKO to provide the relevant aviation weather services will be fully recovered from AAHK through services charges for aviation weather services for aircrafts taking off or landing at HKIA. The additional depreciation and recurrent costs arising from the project will be included in setting the aviation weather services charges for AAHK in future.

IMPLEMENTATION TIMETABLE

25. The estimated implementation schedule of replacing the long-range LIDAR Systems and procuring the SRL Systems and SRDWRs is as follows –

/Target …..

		Target completion date for long-range LIDAR Systems	**Target completion date for SRL Systems**	**Target completion date for SRDWRs**
(a)	Site surveying and preparation[5]	March 2022	March 2022	March 2022
(b)	Main tender invitation	May 2022	June 2022	June 2023
(c)	Award of main contract	November 2022	October 2022	December 2023
(d)	Delivery, installation and post-installation testing of equipment at existing South Runway	September 2024[6]	February 2023	March 2024
(e)	Commissioning of equipment at existing South Runway	December 2024[6]	April 2023	August 2024
(f)	Delivery, installation[7] and post-installation testing of equipment at existing North Runway	September 2024[6]	October 2024	July 2024
(g)	Commissioning of equipment at existing North Runway	December 2024[6]	December 2024	December 2024

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[5] Site surveying and preparation of long-range LIDAR Systems, SRDWRs and SRL Systems will be conducted in one go for better coordination.

[6] As explained in paragraph 5 above, while HKO has stepped up cleaning and preventive maintenance of the existing LIDAR Systems and will continuously monitor their performance, HKO expects that the existing LIDAR Systems will need to be replaced by around end 2024 when their performance and reliability can no longer effectively support windshear alert services. HKO will closely monitor the on-going performance and reliability of the existing Systems to determine the installation time of the new Systems.

[7] Installation works involving the existing North Runway will need to tie in with the works for reconfiguring the existing North Runway into the future Centre Runway from 2022 to 2024.

PUBLIC CONSULTATION

26. HKO consulted the aviation users through the Liaison Group on Aviation Weather Services, comprising representatives from AAHK, pilots and airlines. They are supportive of the proposals. We also consulted the Panel on Economic Development of the LegCo on 26 April 2021. Members supported the submission of the proposal to the FC for funding approval.

Commerce and Economic Development Bureau
Hong Kong Observatory
June 2021