International Civil Aviation Organization

The Fourth Meeting of the Asia/Pacific Aerodrome Design and Operations Task Force (AP-ADO/TF/4)

Hybrid Meeting, Chiang Rai, Thailand, 10 to 13 January 2023

Agenda Item 2: Planning, Design and Construction of Aerodromes

DEVELOPMENT OF FULLY INTEGRATED SAFEGUARDING SURFACES TO UPHOLD FLIGHT SAFETY WHILE FACILITATING PRESSING NEEDS OF INFRASTRUCTURE/BUILDING DEVELOPMENTS IN HONG KONG

(Presented by Hong Kong, China)

SUMMARY

This paper highlights potential impacts on airport and ATC operation induced by erection of new/modification of existing buildings at or in vicinity of airports. It presents the successful experience from Hong Kong, China to make use of an advanced computer modelling technology to develop fully integrated safeguarding surfaces with high accuracy and publish them under a legal framework to ensure airport and ATC operation are well protected to uphold flight safety while facilitating the pressing needs of infrastructure/building developments to cope with various economic and development needs of the community.

1. INTRODUCTION

1.1 The Hong Kong International Airport (HKIA) was opened in 1998 and has since developed into one of the busiest airports in the world. For pre-COVID in 2019, the HKIA served 71.3 million passengers, handled 4.7 million tonnes of cargo and accommodated 420,000 air traffic movements. Despite affected by global pandemic, the HKIA handled 4.4 and 5.0 million tonnes of cargo in year 2020 and 2021 respectively, and continues as a leading international and regional aviation hub.

1.2 The Three Runway System (3RS) project at the HKIA is underway in anticipation of future demands from passengers, cargo and aviation community. While various on-airport infrastructure developments are being built to support 3RS operation, new buildings/developments off-airport including those in vicinity of the airport, are planned to be constructed to cope with various economic and development needs of the community. This paper aims to share experience of Hong Kong, China to proactively manage the new developments in vicinity of the airport to ensure aviation safety. Indeed,

in previous ICAO meetings, relevant papers[1] were submitted by member States/Administrations to highlight the risk where operation of airport / ATC could be potentially affected as a result of erection of new/modification of existing buildings at or in vicinity of airports.

1.3 In Hong Kong, three types of safeguarding surfaces are integrated, namely (a) obstacle limitation surfaces for safeguarding aerodrome in accordance with ICAO Annex 14, (b) safeguarding surfaces for ICAO PANS-OPS flight procedures, and (c) safeguarding surfaces for CNS equipment operation, into overall combined surfaces known as the "Airport Height Restriction Plan" (AHRP) under the Hong Kong Airport (Control of Obstructions) Ordinance, which controls building heights with respect to aviation safety. Nowadays with advanced and mature computer modelling technology available, development and integration of voluminous safeguarding surfaces with high accuracy is achievable to ensure overall combined surfaces are not overly stringent while providing sufficient protection.

2. DISCUSSION

2.1 Being the Civil Aviation Authority (CAA) in Hong Kong, the Hong Kong Civil Aviation Department (CAD) is responsible for safeguarding the building heights with respect to aviation safety. Moreover, as a government department, the CAD has been supportive to facilitate various infrastructure projects conducive to economic development at the HKIA and other areas within the territories.

2.2 Traditionally, safeguarding surfaces have been formulated through stringent geometric drawings. For the 3RS project, advanced navigational facilities, new runway/taxiways and terminal building, as well as new flight procedures are being designed and implemented. Taking the opportunity, the CAD adopted the latest ICAO SARPs and guidance materials to review the existing safeguarding surfaces and revamp them whenever appropriate. Thus, three types of safeguarding surfaces, with some 250 nos. 3-dimenional (3D) surfaces for safeguarding CNS equipment, aerodrome and flight procedures, have been developed.

2.3 For CNS safeguarding surfaces which are the lowest limiting surfaces for most cases, a specialized engineering consultant was engaged to carry out comprehensive computer modelling for each CNS equipment against the environment it operates by means of state-of-the-art 3D computer modelling. This ensures that the newly developed CNS safeguarding surfaces can provide sufficient protection on CNS equipment operation while not being overly stringent, which will otherwise constrain development of new infrastructure/buildings, given the prevailing situation of tight supply and high demand of lands for development in Hong Kong to cope with prevailing needs of the community.

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[1] WP59 in CNS/MET SG16 in 2012 – "Obstruction Criteria Beyond ILS Critical and Sensitive Areas – Amendment to Guidance Material in Annex 10"
https://www.icao.int/APAC/Meetings/2012_CNS_MET_SG16/WP59_INDIA%20AI.%205%20-%20ILS%20obstruction%20criteria%20beyond%20critical%20and%20sensitive%20area.pdf

Action Item 52/17 arising from DP/3.3/21 of 52nd DGCA Conference in 2015 – "Achieving Sustainable Airport Development while Upholding Safety – A Perspective from Safeguarding of Communications, Navigation and Surveillance Equipment"
https://www.icao.int/APAC/Meetings/DGCA52/Appendix%20A%20-%20List%20of%20Action%20Items.pdf

2.4 3D computer modelling technique with relevant software tools provides a practicable and cost effective method to simulate the complex local environment which the CNS equipment operates in an automated and customized manner, consisting of surrounding terrains and buildings with different height, location, shape, size, orientation and materials etc. The characteristics of signal transmission of CNS equipment can also be simulated based on information obtained from equipment vendors. With 3D computer modelling, potential impacts on signal performance of CNS equipment by potential buildings with different heights and locations can be accurately simulated and predicted before the buildings are actually erected. The safeguarding surfaces for each CNS equipment, in 3D manner, can be derived to ensure the surfaces so developed are adequate to provide sufficient protection while minimizing constraints to building heights. As a result of the highly accurate computer simulation, coverage and limiting height of the revamped safeguarding surfaces can be less stringent as compared with the existing ones.

2.5 A professional service consultant was also engaged to integrate those 250 nos. of 3D safeguarding surfaces, with voluminous intersecting points/surfaces into overall combined surfaces. The process involved surface formatting, transformation, various validation checks, smoothing and integration, by means of 3D computer modelling. The iterative process was highly complex and handled with high degree of accuracy in formulating a combined set of most limiting surfaces. With assistance from other government bureau/department, the CAD has published the combined surfaces as AHRP under the amended Hong Kong Airport (Control of Obstructions) Ordinance, which became effective on 31 May 2022. As such, AHRP is put on a firm legal footing by incorporation into the law of Hong Kong, which also facilitates compliance by potential infrastructure/building developments. The airport operator has also incorporated relevant AHRP into their future aerodrome planning and design requirements.

2.6 Such a comprehensive and systematic approach is considered beneficial to all stakeholders concerned, including CAAs/Air Navigation Service Providers (ANSPs), airport operators, lands planners and property owners/developers etc, to facilitate development without jeopardizing flight safety. In Hong Kong, in the interest of the safety of aircraft, the CAD, in coordination with the airport operator, assess building plan submissions of both private development applications and government facilities to ensure compliance with AHRP, with a view to controlling building heights while unleashing land use potential at the HKIA and other areas in Hong Kong.

2.7 There could be exceptional cases, where design of a building might need to protrude the safeguarding surface to meet its operational needs. For example, construction of a radio broadcasting towers at hilltops. With fully integrated and highly accurate safeguarding surfaces, there are potential risks induced by protrusion of safeguarding surfaces. Despite there are provisions within the legislation to allow for possible protrusion of a safeguarding surface on exceptional ground of public safety/interest, this is subject to highly stringent scrutiny. For cases protruding CNS safeguarding surfaces, they require detailed computer modelling assessment by the project owner and mitigating measures incorporated in early design of the building, thus ensuring flight safety is never compromised. Hong Kong, China has established a mechanism to keep monitoring performance of the CNS equipment through conducting regular flight checks/ground checks to ensure CNS equipment operation will not be affected during preparation, construction and post-implementation stages of the protruding building.

2.8 Hong Kong, China considered that our experience may serve as a useful and practical reference for the region. States/Administrations are encouraged to take proactive steps to make use of advanced computer modelling technology available to develop and integrate safeguarding surfaces with high accuracy, and publish them under a regulatory framework to ensure operation of CNS equipment, flight procedures and aerodrome are well protected to uphold flight safety while facilitating pressing needs of infrastructure/building developments. Hong Kong, China will be pleased to share our experience with the APAC members.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the on-going developments at or in vicinity of airports, if not properly managed, could constitute changes which may cause impacts on airports and ATC operation;

b) note the experience of Hong Kong, China and encourage States/Administrations to:

i) be fully aware of the potential risks induced by protrusion of safeguarding surfaces; and

ii) make use of advanced computer modelling to develop integrated safeguarding surfaces for CNS equipment, aerodrome and flight procedures with high accuracy, and publish them under a regulatory framework, so as to uphold flight safety while facilitating pressing needs of infrastructure/building developments; and

c) discuss any relevant matter as appropriate.

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