International Civil Aviation Organization

Twenty Fifth Meeting of the Communications/ Navigation and Surveillance Sub-group (CNS SG/25) of APANPIRG

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Agenda Item 12: Discuss and share experience and application of new technologies, including big data analysis, artificial intelligence, Digital Tower, counter UAS detection and identification system, UTM, etc.

DEVELOPMENT OF AN INTEGRATED SAFEGUARDING SURFACE TO UPHOLD FLIGHT SAFETY WHILE FACILITATING INFRASTRUCTURE/BUILDING DEVELOPMENTS IN HONG KONG

(Presented by Hong Kong, China)

SUMMARY

This paper presents the successful experience for Hong Kong, China in facilitating pressing needs of infrastructure/building developments at and in vicinity of the Hong Kong International Airport (HKIA) and within the Hong Kong territories while upholding flight safety. Hong Kong, China has revamped the existing CNS safeguarding surfaces based on comprehensive computer modelling for each CNS equipment against the environment which the equipment operates by means of a state-of-the-art 3-dimensional computer modelling solution. States/Administrations are encouraged to be fully aware of the potential risks induced by protrusion of safeguarding surfaces and take proactive steps to engage advanced computer modelling to enhance protection of their CNS equipment operation while facilitating infrastructure/building developments.

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. In 2019, the HKIA served 71.3 million passengers, handled 4.70 million tonnes of cargo and accommodated 420,000 air traffic movements. Despite affected by global pandemic, the HKIA continues as a leading international and regional aviation hub.

1.2 The Three Runway System (3RS) project at the HKIA is being implemented to cope with the 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 needs of the community. Such developments will inevitably constitute changes to the environment for signal transmission of the CNS equipment. Such changes, if not properly managed, could lead to

degradation in performance of the CNS equipment which will in turn affect the safe and orderly ATC operation.

1.3 In Hong Kong, CNS safeguarding surfaces are integrated with other two types of safeguarding surfaces, namely (a) obstacle limitation surfaces for safeguarding aerodrome in accordance with ICAO Annex 14, and (b) safeguarding surfaces for ICAO PANS-OPS flight procedures, 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/sophisticated computer modelling technologies available and mature, development of accurate CNS safeguarding surfaces is feasible to meet operational needs.

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 signal integrity of CNS equipment so as to ensure that its operation could meet all relevant ICAO requirements. Besides, as a regulatory body of the airport and a government department, CAD is equally supportive to various infrastructure development projects at the HKIA and other areas within the territories.

2.2 Taking opportunity of the 3RS project where the existing AHRP has to be amended to cope with 3RS operation, we have revamped the CNS safeguarding surfaces by engaging a specialized consultant to carry out comprehensive computer modelling for each of the CNS equipment against the environment which the CNS equipment operates by means of state-of-the-art 3-dimensional (3D) computer modelling. This ensures that the newly developed CNS safeguarding surfaces can provide sufficient protection on each CNS equipment operation while not being overly stringent, which will constrain development of new high-rise 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.

2.3 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.

2.4 A professional service consultant was engaged to integrate the three types of safeguarding surfaces into overall combined surfaces. A rough total of 250 nos. surfaces for safeguarding CNS equipment, aerodrome and flight procedures were processed, including surface formatting, transformation, various validation checks, smoothing and integration, by means of 3D computer modelling. With assistance from other government bureau/department, CAD has published the combined surfaces as AHRP under the amended Hong Kong Airport (Control of Obstructions) Ordinance, which was gazetted in August 2021.

2.5 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. CAAs/ANSPs and airport operators are encouraged to establish a cooperative mechanism in supporting upcoming major infrastructure development at their airports.

2.6 There could be exceptional cases, where design of a planned building might protrude the safeguarding surface to meet its operational needs. For example, construction of a broadcasting tower at top of mountain. There are provisions within the legislation to allow for possible protrusion of a safeguarding surface on exceptional ground of public safety/interest, which however, is subject to highly stringent scrutiny requiring 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 building.

2.7 Hong Kong, China considered that our successful experience may serve as a useful and practical reference for the region. States/Administrations are encouraged to be fully aware of the potential risks induced by protrusion of safeguarding surfaces and take proactive steps to make use of advanced computer modelling technologies available to develop 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.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the on-going developments at or in vicinity of an airport, if not properly managed, could constitute changes to the operating environment of CNS equipment which may cause impact to the normal operation of CNS equipment, and in turn will affect safe and orderly ATC operation;

b) note the experience of Hong Kong, China in making use of advanced computer modelling to proactively develop integrated safeguarding surfaces for CNS equipment, aerodrome and flight procedures, and publish them under a regulatory framework, so as to uphold flight safety while minimizing constraints to infrastructure/building developments;

c) encourage States/Administrations to be fully aware of the potential risks induced by protrusion of safeguarding surfaces and take proactive steps for early engagement of advanced computer modelling technologies to enhance protection of their CNS equipment operation; and

d) discuss any relevant matter as appropriate.

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