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FOURTEENTH AIR NAVIGATION CONFERENCE

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Agenda Item 2: Timely and safe use of new technologies
2.2: Addressing safety risks related to evolving aviation technologies

SUGGESTIONS ON THE PLANNING AND CONSTRUCTION OF PLATEAU AIRPORTS

(Presented by China)

EXECUTIVE SUMMARY

Due to the complex terrain, variable climate, and fragile ecosystems, constructing airports in plateau regions has always been a challenge. Collecting the experience of over 40 plateau airports, the Civil Aviation Administration of China (CAAC) is currently researching and drafting the "*Guidelines for Planning and Construction of Plateau Airports*" to provide guidance on site selection, design, and construction of plateau airports. These guidelines aim to outline requirements and recommendations for the planning, design and construction in plateau airports while meeting the safety requirements in the Annex 14 — *Aerordomes* to the Convention on the International Civil Aviation.

Action: The conference is invited to accept the suggestions in Paragraph 3.1.

1. INTRODUCTION

Difficulties in planning and construction of plateau airports

1.1 There are several difficulties in the planning and construction of plateau airports:

a) significant terrain undulation and complex topography bring multiple safety hazards;

b) complexity in clearance and unpredictable weather make site selection and flying challenging;

c) high altitude and hypoxia lead to reduced efficiency-in facilities and equipment and increased fatigue among airport staff;

d) fragile plateau ecosystems are difficult to restore once damaged; and

e) there exist difficulties in energy supply.

[1] Chinese and English versions provided by China.

1.2 Given the numerous challenges in plateau regions, countries and regions tend to deviate significantly from the standards outlined in Annex 14 and lower safety requirements during the planning, design, and construction of plateau airports, which we think should not be encouraged. The ICAO Aerodrome Design and Operations Panel (ADOP) has established a working group for plateau airports and initiated relevant research. The CAAC strongly supports such initiatives of ICAO.

1.3 The CAAC considers the requirements outlined in Annex 14 as the foundation for ensuring flight safety and prerequisites for airport construction. There are more than 40 plateau and high plateau airports in China. The physical characteristics, including runway, runway strips, taxiway, etc., of all these airports in China are designed and constructed in strict compliance with Annex 14 with no exemption of differences; while as for the obstacle limitation surfaces at plateau airports, given the large scale engineering and investment required, it is acceptable to focus only on the obstacles for which handling is necessary and recommended to adopt Required Navigation Performance Authorization Required (RNP AR) flight procedures to better adapt to complex situations. The CAAC is in the process of formulating the "*Guidelines for Planning and Construction of Plateau Airports*", aiming at guiding plateau regions in the site selection, design, and construction of airports while meeting the requirements of Annex 14.

2. DISCUSSION

2.1 Targeting the challenging of plateau airports construction, CAAC has proposed the following suggestions:

2.2 Addressing the complexity of geological foundations at potential sites, the CAAC suggests that areas prone to serious disasters be avoided, such as debris flows, landslides, and flash floods. To tackle adverse geological conditions like permafrost, saline-alkali soil, liquefied soil, weak soil, and collapsible loess in plateau regions, CAAC has developed solutions based on years of exploration and research, which are ready for widespread implementation.

2.3 To address the complex topography at potential sites, the CAAC proposes measures such as constructing bridges, installing reflective nets, implementing arresting systems, and setting up approach lighting bridges, etc. Currently, China has installed Engineered Materials Arresting System (EMAS) in over 13 airports. Despite the fact that these airports have already met the requirements for a 90-meter runway end safety area, we still believe that installing arresting systems is an effective means to enhance the safety of plateau airports. Additionally, the CAAC has proposed in previous ADOP meetings that lighting bridges are highly economical and reliable management measures in the construction of airports in plateau or other special terrain areas. We recommend that the Visual Aids Working Group (VAWG) consider including them as recommended measures in Annex 14 or other manuals on design.

2.4 To address the challenges in site selection for plateau airports, the CAAC proposes the use of digital site selection assistance tools. More specifically, digital technology, mainly based on Geographic Information Systems (GIS) and Building Information Modeling (BIM) tools, systematically organizes, analyzes, and synthesizes data on complex site selection issues. It provides hierarchical decomposition, forms comprehensive evaluation results through quantitative calculations, and applies quantitative and qualitative decision analysis methods to solve complex problems. Digital site selection involves the use of various new technologies to collect and generate big data, integrating comprehensive statistical and analytical methods to achieve more detailed analysis indicators and accuracy, enabling quantitative analysis. Utilizing three-dimensional modeling and visualization technologies, digital site selection presents site elements in a straightforward manner, facilitating the discovery of hidden problems, assisting decision-making, and reducing risks. For example, it can visually identify whether the construction of lighting strips is feasible, whether navigation beacon stations are obstructed, or there are excessively tall structures within the three-dimensional constraints of procedures and performance. Also, it can achieve visual analysis. The

improvement in the accuracy and scientific nature of airport site selection ultimately results in smoother flight operations and enhanced aviation safety. This technology has been successfully applied and achieved practical results at airports such as Foshan new airport, Chongqing new airport, and airports in Enshi, Baicheng, and Jinzhai.

2.5 To address the complexity of airspace and unpredictable weather, the CAAC, based on years of practical experience, suggests focusing on thematic analysis of adverse weather factors such as wind shear, low visibility, strong winds, thunderstorms, and sandstorms, etc. Additionally, CAAC recommends actively adopting Required Navigation Performance Authorization Required (RNP AR) flight procedures in the construction of plateau airports.

2.6 To address the challenges of high-altitude hypoxia during airport construction, the CAAC recommends constructing essential facilities such as oxygen supply, heating, and power supply simultaneously. Additionally, CAAC suggests establishing airport support bases to ensure the health and safety of construction personnel and provide a comfortable working environment for staff after the airport is in operation.

2.7 In response to the issue of fragile plateau ecosystems that are difficult to restore once damaged, the CAAC adheres to the principle of prioritizing environmental protection, while actively implementing ecological environmental protection solutions and emphasizing the importance of conducting environmental impact assessments and risk evaluations during the planning and design stages. Based on the practical experience, CAAC proposes the development of effective restoration measures for aspects such as occupation of construction site, pollutant recycling and treatment, and greening of land surfaces before construction begins.

2.8 In response to the unique natural resource of plateau regions, the CAAC suggests fully utilizing natural resources such as solar, geothermal and wind energy during airport construction. For example, there are multiple cases of using clean energy as heating sources at plateau airports in China, which enable sustainable resource utilization.

2.9 Previously, the CAAC has been invited to share information on plateau airport construction in the Asia-Pacific region for multiple times, gathering attention from counterparts in various countries. In response, CAAC is actively developing the "*Guidelines for Planning and Construction of Plateau Airports*" and concurrently translating it into English for global reference. Additionally, CAAC is participating in the research of ICAO ADOP and striving to offer technical support from China. We also welcome other countries and regions to share their experiences in plateau airport construction, facilitating a positive and steady development of plateau airports under the premise of safety and environmental protection.

3. CONCLUSION

3.1 The conference is invited to accept the suggestions as follows:

a) it's crucial for countries to prioritize environmental protection, site selection, and safety concerns when constructing plateau airports due to their fragile ecological environment, complex terrain, and high safety requirements;

b) urging Aerodrome Design and Operations Panel (ADOP) to expedite the building of the plateau airports planning and design working group and encouraging countries with relevant experience to actively participate in and contribute to the research on guiding documents;

c) as Annex 14 — *Aerodromes* requirements are fundamental for airport safety operations, we suggest countries and states should focus on the conditions of keeping plateau airports operation safely. The physical characteristics, including runway, runway strips, taxiway, etc., of the plateau airports should strictly comply with Annex 14;

d) encouraging other countries to share their experiences in plateau airports with respect to planning and construction to collectively enhance the quality of plateau airports; and

e) the Civil Aviation Administration of China (CAAC) will accelerate the drafting of the "*Guidelines for Planning and Construction of Plateau Airports*" and share its English version, which will be highly beneficial for airport planning and construction. Other countries are welcomed to refer to and utilize it in the future.

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