



WORKING PAPER

FOURTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 26 August to 6 September 2024

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

**NEED FOR STANDARDIZATION AND GUIDANCE MATERIAL FOR
UNMANNED AIRCRAFT SYSTEM (UAS)-BASED FLIGHT INSPECTION**

(Presented by China)

EXECUTIVE SUMMARY

With the rapid and extensive advancement of unmanned aircraft systems (UAS), the aviation industry is witnessing a transformative shift. Flight inspection organizations and services providers across different States/Administrations are actively exploring and implementing UAS-based solutions for conducting flight inspections on navigation aids and airfield ground lighting systems. The progressive approach aims to unlock a multitude of benefits, especially in terms of high mobility, enhanced efficiency, cost reduction and environmental sustainability. Recognizing the emerging trend and the tangible operational benefits offered by UAS-based flight inspection, there is a growing need to establish a harmonized approach with standardized practices and guidance materials to ensure consistent and effective utilization of UAS in flight inspection.

Action: The Conference is invited to:

- a) note the information in this working paper; and
- b) agree on the recommendation in paragraph 3.

1. INTRODUCTION

1.1 Flight inspection organizations and service providers in various States/Administrations have utilized UAS to supplement and support flight inspections of navigation aids and airfield ground lighting systems, such as Precision Approach Path Indicators (PAPI). This approach offers cost-saving, flexible deployment, and environmental benefits.

1.2 Since 2017, the Research and Development (R&D) team in China has been dedicated to studying and researching UAS-based flight inspection technologies. A series of trial flights conducted in China have successfully proved the feasibility and benefits of UAS-based flight inspection.

1.3 Several trial flights were conducted in Shangdong Dongying Airport in China in June 2019 and between December 2019 and October 2020, to assess the functions and performance of the UAS

¹ English and Chinese versions are provided by China.

flight inspection platform and the effective payload under various weather and day-night conditions. Additionally, in June 2021, thirteen successful trial flights were conducted at the challenging Nyingchi Mainling Airport, located at the mountainous plateau area in China, to evaluate UAS-based flight inspection for airfield ground lighting systems across diverse terrain, weather and lighting conditions.

1.4 To better assess the feasibility of UAS-based flight inspection in a busy international airport environment, the Flight Inspection Center(FIC) of Civil Aviation Administration of China (CAAC) collaborated with the Civil Aviation Department of Hong Kong China (HKCAD), and conducted four trial flights at the Hong Kong International Airport (HKIA) in August 2023 and May 2024, to assess UAS-based flight inspection for PAPI, Instrument Landing System (ILS), and Doppler Very High Frequency Omnidirectional Range (DVOR) equipment. These trial flights successfully proved the feasibility and benefits of implementing UAS-based flight inspection over traditional flight inspection in international airports with high air traffic volume.

1.5 In September 2020, the CAAC published the first technical specifications on fixed-wing/hybrid-wing UAS-based civil aviation flight inspection systems. This significant milestone marked a crucial step in establishing standards for UAS-based flight inspection. The published specifications detail the essential functions, performance requirements, requirements for system components, antennae, core units (including inspection receivers, signal acquisition units, and evaluation and processing units), as well as requirements for tagging, documentation, transportation, and storage.

1.6 Building upon the knowledge gained from R&D and trial flights as well as development of technical specifications, the CAAC established a comprehensive national standard and regulatory framework in November 2021. This standard/framework covers equipment, crew and operation management, to guide and promote the development and application of UAS-based flight inspection, with continuous updates to address evolving requirements. The standard/framework was shared with States/Administrations at meetings of the ICAO Navigation Systems Panel (NSP) and ICAO Asia and Pacific Regions Communications, Navigation and Surveillance Sub-group (CNS SG).

2. DISCUSSION

2.1 In today's rapidly evolving landscape of UAS technology and its applications in flight inspection, the development of corresponding governing standards and guidance materials is lagging behind. Some States/Administrations, along with their flight inspection organizations and service providers, are using UAS to inspect signals of navigation aids and airfield ground lighting systems, as supplement to traditional flight inspection aircraft. However, the approaches currently employed vary due to differences in performance capabilities of UAS, such as speed, service ceiling, endurance, crosswind resistance, effective payload capacity, and more. As a result, not all UAS models are equally suitable for each flight inspection mission. Furthermore, the performance, operation, maintenance, and safety management considerations for multi-rotor, fixed-wing, or hybrid-wing UAS used in flight inspection can differ significantly.

2.2 Despite the absence of ICAO standards and guidance materials², there have been extensive trials and/or implementation on UAS-based flight inspections worldwide, for example by the Civil Aviation Authorities (CAAs), Air Navigation Services Providers (ANSPs), and related flight inspection organizations and services providers in various regions, such as China, Columbia, France,

² The ICAO Asia and Pacific Regional Office published the "[Flight Inspection Guidance Material \(FIGM\) Edition 3.0](#)" in September 2022, which contains an Appendix 2 to provide brief guidance on use of emerging technology (e.g. UAS) to supplement flight inspection.

Germany, Greece, Iceland, Italy, Mexico, the Netherlands, Republic of Korea, Russia, Spain, Switzerland, and more.

2.3 Presently, Section 18 of Chapter 1 in the fifth edition of the *Manual on Testing of Radio Navigation Aids* (Doc 8071), Volume I — *Testing of Ground-based Radio Navigation Systems* provides a brief and high-level description of flight inspection using Remotely Piloted Aircraft Systems (RPAS) or Unmanned Aerial Vehicles (UAV). However, it does not provide detailed information on relevant standards and guidance. Since 2021, China has been actively sharing its R&D progress on UAS-based flight inspection and development of relevant national standard/framework with the ICAO National Safety Plan (NSP) meetings. China has also raised the need for ICAO standards and guidance materials for UAS-based flight inspection during the NSP meetings. This includes proposals to add content to Doc 8071 to cover this subject with relevant standards and guidance materials to promote and facilitate the use of UAS in flight inspection.

2.4 The national standard/framework in China for UAS-based flight inspection consists of three parts, which were shared with the NSP Joint Working Groups (JWGs)/9 and NSP/7 meetings:

- a) technical specifications for UAS platforms and their inspection systems;
- b) flight inspection technical requirements for Communications, Navigation and Surveillance (CNS) facilities and airfield ground lighting systems; and
- c) regulations for crew qualifications and operations.

2.5 The technical requirements for UAS-based flight inspection platform mainly consist of three parts, with detailed information shared during the NSP JWGs/10 meeting:

- a) system composition;
- b) general requirements; and
- c) technical requirements.

2.6 Although there are existing ICAO standards and guidance materials for traditional flight inspection, they do not adequately cover the domain of UAS-based flight inspection. A harmonized approach with common standards and guidance materials has become increasingly important to ensure that any trials and/or implementation of UAS-based flight inspection will not be conducted in a fragmented manner with potential loopholes, where safety might be compromised.

2.7 There is a need for stakeholders, including ICAO, CAAs, air navigation services providers (ANSPs), flight inspection organizations and services providers, as well as relevant R&D institutions and academia etc., to work together and expedite development of corresponding standards and guidance materials on relevant technical specifications, requirements, and crew qualifications, to govern the trials and implementation of UAS-based flight inspection worldwide in a safe and efficient manner.

3. CONCLUSION

3.1 The Conference is invited to agree on the following recommendation:

Recommendation 2.2/x – Standardization and guidance material for UAS-based flight inspection

3.2 That the Conference to:

- a) note the progress of UAS-based flight inspection, trials and development of standard/framework in China;
- b) note the diversified approaches in UAS-based flight inspection being developed and adopted in different States/Administrations;
- c) note the importance to have a harmonized approach with common standards and guidance materials for the safe and efficient implementation of UAS-based flight inspection;
- d) urge ICAO to expedite the development of Standards and guidance materials, in conjunction with stakeholders, for the implementation of UAS-based flight inspection; and
- e) urge ICAO to consider including the application of UAS-based flight inspection in the *Manual on Testing of Radio Navigation Aids* (Doc 8071).

— END —