International Civil Aviation Organization

Twenty Seventh Meeting of the Communications/ Navigation and Surveillance Sub-group (CNS SG/27) of APANPIRG

Bangkok, Thailand, 28 August – 01 September 2023

Agenda Item 6: Navigation

6.4 Other navigation related matters

FEASIBILITY STUDY AND TRIAL OF USING DRONE TO ENHANCE EFFICIENCY IN FLIGHT INSPECTIONS AT THE HONG KONG INTERNATIONAL AIRPORT

(Presented by Hong Kong, China)

SUMMARY

With drone technology being widely and rapidly developing, flight inspection service providers have been researching into using drone to carry out flight inspections with a view to enhancing efficiency, reducing cost while being environmentally friendly. This paper presents the initiative from Hong Kong, China, supported by the Flight Inspection Center of Civil Aviation Administration of China, in exploring use of drone technology to enhance efficiency in flight inspections and conducting feasibility study on carrying out part of flight inspections at the HKIA by drone. A trial was successfully conducted at the HKIA with promising outcomes.

1. INTRODUCTION

1.1 According to the ICAO standards, radio navigation aids available for use by aircraft engaged in international air navigation shall be subject to periodic flight and ground inspections. Conventional manned flight inspection and ground inspection on navigational aids have their respective limitations. For manned flight inspection, it normally requires day light operation. Despite substantial coordination among air traffic control, airport operator and flight inspection service provider is done in prior, disturbance to air traffic control and airport operations is sometimes unavoidable. For ground inspection, the reachable distance and height for measuring antenna has restrained effectiveness in ground measurement on signal-in-space.

1.2 The ICAO has encouraged States/Administrations to explore feasibility of making use of innovation and emerging technology, such as drone technology, to enhance efficiency in conduct of flight inspections for navigational aids. The ICAO has also been developing relevant standards and guidelines. The Hong Kong Civil Aviation Department (HKCAD) has taken an initiative in exploring feasibility of carrying out part of flight inspections at the Hong Kong International Airport (HKIA) by drone. Generally speaking, carrying out part of flight inspections by drone is more efficient in deployment with greater flexibility in flight manipulation and environmentally friendly. The

measurement on signal-in-space using drone capable of vertical manipulation could be more accurate. It is also more cost effective with less operating and maintenance efforts, crew resource as well as enroute and parking charges to be incurred as compared to using traditional flight inspection aircraft.

1.3 The Flight Inspection Center of Civil Aviation Administration of China (CAAC FIC), being the flight inspection agent for the HKIA, is a leading and highly competent organization in providing flight inspection services. In 2022, based on the knowledge and experience gained from intensive research and development work and trials, CAAC FIC has developed technical specifications for drone flight inspection systems and presented them during the ICAO Navigation Systems Panel (NSP) meetings. They also shared experience in trials and progress of standards development, as well as updated the APAC Flight Inspection Guidance Manual (FIGM) in the CNS Sub-group meeting in 2022, with a view to promoting use of drone for carrying out flight inspections.

1.4 With the self-developed drone flight inspection system, the CAAC FIC had successfully conducted trials on flight inspections using drone for navigational aids and Precision Approach Path Indicator (PAPI) in some airports in Mainland China.

1.5 Considering the potential benefits that could be brought by using drone to carry out flight inspections and the CAAC FIC's competency and experience, the HKCAD has been collaborating with the CAAC FIC on feasibility study of using drone for carrying out part of flight inspections and conducted a trial at the HKIA in August 2023.

2. DISCUSSION

2.1 The scope of the trial included using drone to carry out part of flight inspections over the North Runway of the HKIA for one Localizer (LOC) of Instrument Landing System (ILS) and one set of PAPI lights. Specific profiles were designed for the drone to measure key parameters of the equipment, such as LOC alignment, structures, PAPI angles, etc. during the inspection.

2.2 Two types of drone were adopted in the trial. One was a six-rotor drone equipped with an ILS signal receiver capable of flying for around 30 minutes up to speed at 15 m/s for inspecting LOC signals. Another one was a four-rotor drone equipped with a high-definition video camera capable of flying for around 30 minutes up to speed at 17 m/s for inspecting PAPI lights. The drone operations were programmed with pre-defined flying routes. With the aids of differential GPS to enhance position accuracy, the drone followed the pre-programmed routes precisely to conduct measurements with monitoring by the drone operator throughout the whole process. The real-time measurements by the drone were viewable on-site via a remote monitoring system.

Fig. 1 – The six-rotor drone for inspecting LOC signals

Fig. 2 – Drone flying along the center line over the North Runway to inspect LOC signals

Fig. 3 – The four-rotor drone for inspecting PAPI lights

Fig. 4 – Screenshots of the real-time remote monitoring system

2.3 The trial was successfully completed in a safe and efficient manner. To ensure aviation and public safety, the law for drone activities in Hong Kong, namely the "Small Unmanned Aircraft Order", was strictly adhered to during the trial. The drone operator had to maintain full-time visual line-of-sight with the drone. To minimize potential impacts to HKIA operations, the trial was conducted during closure period of the North Runway.

2.4 The trial preliminarily testified that carrying out part of the flight inspections by drone for navigation aids and PAPI over the North Runway of the HKIA is more efficient in deployment with greater flexibility in flight manipulation while achieving zero carbon emission. Its inspection results are also in line with those obtained by traditional flight inspection aircraft.

2.5 To draw on the successful experience of the trial, the HKCAD will continue the feasibility study of using drone to carry out part of the flight inspections and conduct upcoming trials in conjunction with relevant stakeholders. The HKCAD will also keep close monitoring on relevant ICAO standards and guidelines being developed, with a view to enhancing efficiency and flexibility of conducting flight inspections for the HKIA.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the initiative by Hong Kong, China in exploring use of drone technology to enhance efficiency in flight inspections and conducting feasibility study and trial on carrying out part of flight inspections at the HKIA by drone;

b) encourage CAAs/ANSPs who have undertaken similar feasibility studies, trials and flight inspections using drone to share their experience; and

c) discuss any relevant matters as appropriate.

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