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THIRTEENTH AIR NAVIGATION CONFERENCE

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COMMITTEE A

Agenda Item 2: Enabling the global air navigation system
2.2: Integrated CNS and spectrum strategy

UAV FLIGHT INSPECTION SYSTEM

(Presented by China)

EXECUTIVE SUMMARY

This paper presents a flight inspection system installed on large-size, fixed-wing unmanned aerial vehicle (UAV) platforms to deploy at civil airports and execute flight inspection of ground communications, navigation, and surveillance (CNS) facilities. With its compact, light-weight, highly-integrated design, UAV flight inspection system (UFIS) will be operating with lower cost as well as other advantages. UFIS system layout, flight inspection capabilities, and other contents are discussed in this paper.

1. INTRODUCTION

1.1 Unmanned aerial vehicle (UAV) flight inspection system (UFIS) consists UAV platform, data link, ground station and command centre, ground surveillance and command system, operation and maintenance system. The design, production, and ground & flight tests and operation are based on the requirements of regulations, standardization and management documents of the Civil Aviation Administration of China (CAAC), ICAO, the Joint Authorities for Rulemaking on Unmanned Systems (JARUS), etc.

1.2 With the development and improvement of unmanned aircraft systems (UAS), a variety of industrial grade, fixed-wing UAV platforms meets the criteria of performing flight inspection missions. As the pilots and inspection personnel are now operating the UFIS from ground sites, flight risks and costs are considerably reduced, meaning that high-risk missions, general airports flight inspections can be covered by UFIS. In conclusion, UFIS will be beneficial in various aspects.

¹ English and Chinese versions provided by China

2. DISCUSSION

2.1 UFIS System Layout

2.1.1 UFIS consists of UAV platform, data link, ground station and command centre, ground surveillance and command system, operation and maintenance system. Each system consists of numbers of sub-systems. The system layout of UFIS is shown in Figure 1.



Figure 1. UFIS Layout

The UAV platforms chosen for UFIS are all fixed-wing UAVs. Wingspan range from 8.5 to 15 metric meters, service ceiling starts at 5 000 m and tops at 8 000 m. Load capabilities range from 50-150kg. Endurance max. is 14 hours. The specification of one UAV platform (UFI-01) is shown in Figure 2, UFI-01 ground tests in a civil airport runway in China is also shown in Fig.2.

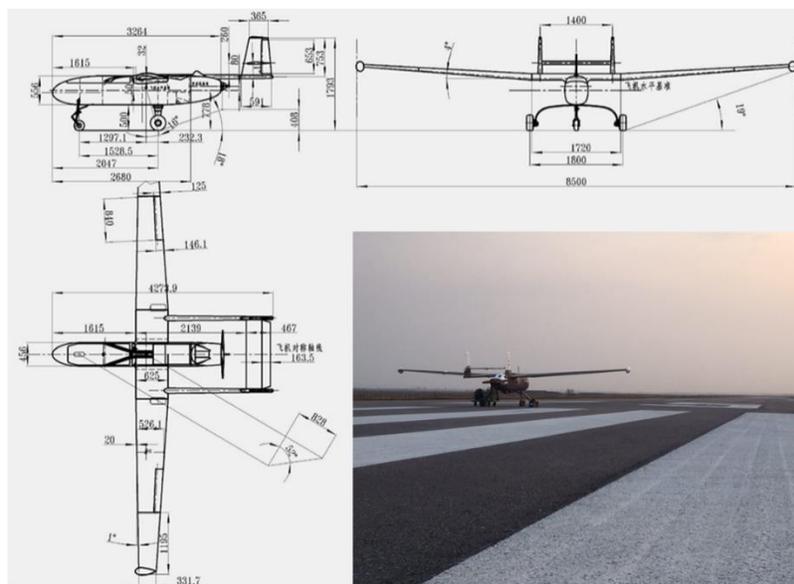


Figure 2. UFI-01 Specs and Ground Tests

2.1.2 The mission load mounted on UAVs for flight inspection missions is designed under the general ideas of light-weight, compact-size, highly-integrated design philosophy. UAV platform captures the CNS ground station's space signal and transmits through the data link to the ground station in a real-time mechanism. The data received on the ground is then processed by software and flight inspection and evaluation of ground stations is achieved.

2.1.3 Ground station and command centre pilots the UAVs, receives the flight inspection data and analyses. It is the prior control station of the UFIS.

2.1.4 Ground surveillance and command system offer on-site command and control on a grand scale, including the situation sensing of the airfield and surrounding airspace. This system will operate in close corporation of the airport air traffic control (ATC) and tower, to ensure the safety of UFIS and other air and ground vehicles and personnel. Ground surveillance and command system are shown in Figure 3.



Figure 3. Ground Surveillance and Command System

2.1.5 Operation & maintenance system includes flight inspection data center and other maintenance facilities. Its task is to ensure a robust and safe operation of the UFIS.

2.2 **Flight inspection capabilities**

2.2.1 Based on current UAV platform capacity (50-150 kg), UFIS is capable of executing flight inspection of instrument landing systems (ILS) (LOC/GS/MRK), very high frequency (VHF) omnidirectional radio range VOR/DME, automatic direction finder (ADF), area navigation (RNAV), automatic dependent surveillance — broadcast (ADS-B) and etc. Functions can be altered based on mission requirements.

2.2.2 As UFIS is capable of performing flight tests including ILS, VOR/DME, RNAV, ADS-B and other more CNS facilities, in accord with ICAO Doc 8071, *Manual on Testing of Radio Navigation Aids* standards, UFIS possess international operation potentials.

2.2.3 Further and continuous ground and flight tests of UFIS will be carried out, following the supervision of CAAC and with the guidance of ICAO's related policies and publications.

2.2.4 UFIS flight inspection procedure and profile are in accord of manned flight inspection systems. Details of flight inspection program/procedures will not be discussed in this paper.

2.3 **Standard and other references**

The design and operation of UFIS are based on the following documents and references:

- Doc 8071 (Fourth Edition-2000)
- ICAO Annex 10 — *Aeronautical Telecommunications* (Sixth Edition-2006)
- ICAO Annex 14 — *Aerodromes* (Fourth Edition-2004)
- United States Standard Flight Inspection Manual (FAA 8200.1C 2005)
- United States Standard Flight Inspection Manual (FAA 8200.1A 2000)
- CAAC CCAR-86
- CAAC AC-86-TM-2016
- CAAC MD-TM-2016-004
- JARUS guidelines on Specific Operations Risk Assessment (SORA) JAR-DEL-WG6-D.04

3. **CONCLUSION**

3.1 The meeting is invited to:

- a) Note the information contained in this paper; and/or
- b) discuss any relevant matter as appropriate.

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