International Civil Aviation Organization

Twenty Sixth Meeting of the Communications/ Navigation and Surveillance Sub-group (CNS SG/26) of APANPIRG

Video Tele-Conference, 5 – 9 September 2022

Agenda Item 6: Navigation

6.3 Update of Flight Inspection Guidance Material (FIGM)

UPDATE OF FLIGHT INSPECTION GUIDANCE MATERIAL (FIGM)

(Presented by China and Hong Kong, China)

SUMMARY

This working paper is jointly prepared by China and Hong Kong, China, with the support from Australia and Singapore, to propose updates to the Flight Inspection Guidance Material (FIGM).

1. INTRODUCTION

1.1 The second edition of the Flight Inspection Guidance Material (FIGM) was adopted by the 25th Meeting of ICAO APAC CNS Sub-Group on 22 October 2021.

1.2 The FIGM is subject to regular review and update, in the light of on-going development of flight inspection standards and recommended practices. The Civil Aviation Administration of China (CAAC) Flight Inspection Center (FIC) and Hong Kong, China have volunteered to jointly conduct a review on the contents of the FIGM and propose updates, with contributions from Australia and Singapore, in this paper.

1.3 In view of the continuous impact by COVID-19, it is proposed to provide additional guidance in the FIGM on arrangement for flight inspections under pandemic situation. Besides, guidelines in adopting surveillance flight inspection for newly commissioned navigation systems, and minor amendments, including the experience of using drone for flight inspections and editorial updates, are proposed in the new version of the FIGM. Details of the amendments are given below.

2. DISCUSSION

2.1 To cope with the dynamic pandemic situation, new paragraphs, stipulated in **Appendix 1** of this paper, are proposed to be added in the FIGM, so as to provide additional guidance on the advance planning for arranging flight inspections under pandemic situation.

2.2 With reference to the practice in some APAC States/Administrations, it is also suggested to add new paragraphs, stipulated in **Appendix 2** of this paper, to adopt surveillance flight inspection to the safety-critical navigation systems as part of the commissioning flight inspection programme.

2.3 It is proposed to supplement new paragraphs, stipulated in **Appendix 3** of this paper, on the application of UAS for flight inspection, which was shared by China during the CNS SG/25.

2.4 Other editorial updates as detailed in **Appendix 4** to this paper.

2.5 With the aforementioned, a draft conclusion is formulated and proposed for endorsement by the CNS Sub-group as follows:

Draft Conclusion CNS/SG/26/XX - Update of Flight Inspection Guidance Material (FIGM)	
What: That, the Edition 3.0 of the Flight Inspection Guidance Material (FIGM) provided in Appendix 4 to this paper be adopted.	Expected impact: ☐ Political / Global ☐ Inter-regional ☐ Economic ☐ Environmental ☒ Ops/Technical
Why: The FIGM is subject to regular review and update, in the light of on-going development of flight inspection standards and recommended practices.	Follow-up: ☐Required from States
When: 9-Sep-22	Status: Draft to be adopted by Subgroup
Who: ☒Sub groups ☒APAC States ☒ICAO APAC RO ☐ICAO HQ ☐Other:	

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper;

b) recognize the contributions from Australia, China, Hong Kong China and Singapore on the updated contents;

c) review and provide comment, if any, on the proposed updates to the FIGM in **Appendix 4**;

d) endorse the Draft Conclusion in paragraph 2.5;

e) encourage States/Administrations to incorporate the updates into their respective flight inspection manuals, as well as contribute to the regular review and updates of the FIGM, in the light of ongoing development of flight inspection standards and recommended practice; and

f) discuss any relevant matter as appropriate.

– – – – – – – – – – – – –

Appendix 1

2.5.3 During pandemic situation, every country may have different travel restriction policies in place to contain the spread of pandemic. Cross-country deployment of flight inspection may become difficult or infeasible due to border closure, especially for those States who do not have their own FISP. Therefore, States may have to consider to deploy flight inspection crew and aircraft to alternative base for timely completion of flight inspection. In this situation and to safeguard the health condition of flight inspection crew, the following considerations could be made when planning for the flight inspection:

(a) Negotiate with the FISP in advance for performing flight inspection from alternative base where is classified as low risk of the epidemic situation;

(b) Seek support from the government of the alternative base for the flight inspection activities;

(c) Work with local government to apply for exemption permits for the FISP to enter States If deployment from alternative base in another country is not possible, either due to border closure or not practical. The States should cater ample time when applying such permits so to ensure all the systems and facilities still comply with the State's regulatory requirement on the periodicity of flight inspection;

(d) Encourage FISP to develop a special management plan for performing flight inspection under pandemic as it may facilitate the exemption permits application in States. The pandemic management plan could include the following areas:

(i) Hazard & risk management

(ii) Fitness for duty evaluation for FISP crew – daily body temperature & symptoms check records

(iii) Self-isolation requirements for FISP crew

(iv) Mask wearing, social distancing and personal hygiene requirements for FISP crew

(v) Incident reporting mechanism

(vi) Contact tracing documents - names / telephone of physical contacts with FISP crew

(e) Develop special arrangements during the flight inspection period, for example:

(i) Seek support from the relevant party to set up all essential ground equipment for flight inspection, e.g. DGPS equipment, locally and by local staff, instead of the flight inspection crew to be deployed;

(ii) Arrange point to point transportation between the airport and accommodation for the flight crew with close-loop arrangement as far as practicable;

(iii) Conduct virtual meeting with the FISP for coordination and discussion on the flight inspection reports to avoid face to face meetings;

(iv) Create controlled itinerary for the flight inspection crew, where the flight inspection crew is only allowed to leave their accommodation to carry out the flight inspection. This will minimize the physical interaction between the flight inspection crew and the public; and

(v) Keep up to date with the latest requirements of the exemption permits applied, e.g. the need for the flight inspection crew to take Polymerase Chain Reaction (PCR) tests during the flight inspection period and the maximum number of days the flight inspection crew is allowed to stay.

(f) Such special/additional arrangements may incur extra cost for each deployment. The flight inspection crew might need to be quarantined upon return to the country where the FISP is based. States should consider these additional costs when planning for each deployment.

Appendix 2

3.2.2 Surveillance Flight Inspection

3.2.2.1 Surveillance flight inspection may be arranged for providing supplementary check and verification on the performance of the newly commissioned radio navigation aids, before its next required periodic flight inspection. Since the stability on operating environment and new system itself are yet to be demonstrated, the additional surveillance flight inspection could early detect any potential issues on system performance after commissioning and before the next routine check. Maintenance staff could then take prompt and appropriate actions to rectify the issues spotted to avoid safety hazards.

Appendix 3

3.4. China

(a) In CNS/SG/25 meeting, China has shared their trials and application of UAS as well as the progress of standards development. Some reference materials contributed by China are summarized below for reference:

i) UAS-Based PAPI Inspection Technology in China
https://www.icao.int/APAC/Meetings/2021%20CNS%20SG%2025/WP24_CHN%20AI.12%20-%20UAS-based%20PAPI%20Inspection%20Technology%20in%20China.pdf

ii) Standard Establishment of UAS-Based Flight Inspection System in China
https://www.icao.int/APAC/Meetings/2021%20CNS%20SG%2025/Flimsy%2003_CHN%20AI.12%20-%20Standard%20establishment%20of%20UAS-based%20flight%20inspection%20system%20in%20China.pdf

iii) Standard Establishment of Data Link for UAS-Based Flight Inspection in China
https://www.icao.int/APAC/Meetings/2021%20CNS%20SG%2025/IP15_CHN%20AI.12%20-%20Standard%20Establishment%20of%20Data%20Link%20for%20UAS-based%20Flight%20Inspection.pdf

Appendix 4

PROPOSED UPDATES TO
FLIGHT INSPECTION GUIDANCE MATERIAL
(SECOND EDITION)

NOTES ON THE PRESENTATION OF THE PROPOSED AMENDMENT

1. The text of the amendment is arranged to show deleted text with a line through it and new text highlighted with grey shading, as shown below:

a) ~~Text to be deleted is shown with a line through it.~~	text to be deleted
b) New text to be inserted is highlighted with grey shading.	new text to be inserted
c) ~~Text to be deleted is shown with a line through it~~ followed by the replacement text which is highlighted with grey shading.	new text to replace existing text

– – – – – – – – – – – – –

***Page (vii)* of Flight Inspection Guidance Material (Second Edition)**

ABBREVIATIONS

DF	Direction Finder
DGPS	Differential Global Positioning System
UAS	Unmanned Aerial System

– – – – – – – – – – – – –

***Page 2-12* of Flight Inspection Guidance Material (Second Edition)**

2.5.3 During pandemic situation, every country may have different travel restriction policies in place to contain the spread of pandemic. Cross-country deployment of flight inspection may become difficult or infeasible due to border closure, especially for those States who do not have their own FISP. Therefore, States may have to consider to deploy flight inspection crew and aircraft to alternative base for timely completion of flight inspection. In this situation and to safeguard the health condition of flight inspection crew, the following considerations could be made when planning for the flight inspection:

(a) Negotiate with the FISP in advance for performing flight inspection from alternative base where is classified as low risk of the epidemic situation;

(b) Seek support from the government of the alternative base for the flight inspection activities;

(c) Work with local government to apply for exemption permits for the FISP to enter States If deployment from alternative base in another country is not possible, either due to border closure or not practical. The States should cater ample time when applying such permits so

to ensure all the systems and facilities still comply with the State's regulatory requirement on the periodicity of flight inspection;

(d) Encourage FISP to develop a special management plan for performing flight inspection under pandemic as it may facilitate the exemption permits application in States. The pandemic management plan could include the following areas:

(vii) Hazard & risk management

(viii) Fitness for duty evaluation for FISP crew – daily body temperature & symptoms check records

(ix) Self-isolation requirements for FISP crew

(x) Mask wearing, social distancing and personal hygiene requirements for FISP crew

(xi) Incident reporting mechanism

(xii) Contact tracing documents - names / telephone of physical contacts with FISP crew

(e) Develop special arrangements during the flight inspection period, for example:

(i) Seek support from the relevant party to set up all essential ground equipment for flight inspection, e.g. DGPS equipment, locally and by local staff, instead of the flight inspection crew to be deployed;

(ii) Arrange point to point transportation between the airport and accommodation for the flight crew with close-loop arrangement as far as practicable;

(iii) Conduct virtual meeting with the FISP for coordination and discussion on the flight inspection reports to avoid face to face meetings;

(iv) Create controlled itinerary for the flight inspection crew, where the flight inspection crew is only allowed to leave their accommodation to carry out the flight inspection. This will minimize the physical interaction between the flight inspection crew and the public; and

(v) Keep up to date with the latest requirements of the exemption permits applied, e.g. the need for the flight inspection crew to take Polymerase Chain Reaction (PCR) tests during the flight inspection period and the maximum number of days the flight inspection crew is allowed to stay.

(f) Such special/additional arrangements may incur extra cost for each deployment. The flight inspection crew might need to be quarantined upon return to the country where the FISP is based. States should consider these additional costs when planning for each deployment.

– – – – – – – – – – – – –

***Page 3-5* of Flight Inspection Guidance Material (Second Edition)**

3.2 OTHER TYPES OF FLIGHT INSPECTION

3.2.1 Procedure Validation

3.2.1.1 This is detailed in ICAO Doc 9906, Quality Assurance Manual for Flight Procedure Design. Volume 5 – Validation of Instrument Flight Procedures. The ANSP, FISP and Procedure Design Company need to work closely to ensure this aspect is covered off adequately.

3.2.2 Surveillance Flight Inspection

3.2.2.1 Surveillance flight inspection may be arranged for providing supplementary check and verification on the performance of the newly commissioned radio navigation aids, before its next required periodic flight inspection. Since the stability on operating environment and new system itself are yet to be demonstrated, the additional surveillance flight inspection could early detect any potential issues on system performance after commissioning and before the next routine check. Maintenance staff could then take prompt and appropriate actions to rectify the issues spotted to avoid safety hazards.

~~3.2.1.1~~3.2.3 VHF equipment, ADS-B, GBAS

~~3.2.2.1~~3.2.3.1 Flight inspection is typically carried out under request from an appropriately trained Communications/ADS-B or GBAS engineer. The specifics such as location, type of check and flight profiles are determined by a collaborative approach between all involved disciplines. In some cases, flight inspection is used to assist in the validation of models for determining coverage.

~~3.2.3~~3.2.4 Performance-based Navigation – RNAV and RNP

~~3.2.3.1~~3.2.4.1 At a minimum, the aircraft should have the capability to undertake the desired procedure validation. RNP procedures' validation requirements would normally be specified within the Procedure Design Company specifications. The Aeronautical Design and Development organization should analyze the results to determine containment within the specified criteria. Technical assessment perspective is as follows;

(a) Validation of obstacle survey data is recommended during the flight validation process.

(b) Verification of survey data can be performed by setting ground stations at certain survey points. The ground survey team can check and compare the DGPS signal to the TSO avionic aircraft receiver position.

(c) The survey data may be affected by waypoint, track and bearing error.

(d) The effect of terrain shielding should be taken into consideration.

(e) Verification is often done slightly lower than the published profile to remove altimeter error as often it is advantageous to verify in the worst-case position.

3.3.1 Test Accuracy Ratios (TAR)

3.3.1.1 As the results obtained by the flight inspection system could potentially be used to defend a service provider in the event of an incident or accident, the State should clearly specify the standards adopted in the maintenance and calibration of the systems used for flight inspection purposes. To effectively perform calibration of a system, the calibration equipment should be typically ~~five~~ 5 times (minimum ~~three~~3 times) ~~times~~ more accurate than the system equipment. Some considerations should be as follows:

(a) Temperature stability and compensation.

(b) Electromagnetic interference.

(c) Polar Pattern considerations.

(d) Absolute measurements.

(e) Relative measurements.

(f) Aircraft receiver and calibration equipment duplication.

– – – – – – – – – – – – –

App-1 Appendix 1

1. USEFUL REFERENCE

- ICASC Website
  http://www.icasc.co

- ICASC - Document on Standards and Recommended ~~Practises~~ Practices for Flight Inspection & Flight Validation Organisations
  http://www.icasc.co/sites/faa/uploads/documents/Library/ICASC/ICASC_SARPs_FI_FV_v14_11102018_final101.pdf

- ICASC Recommended Flight Inspection & Flight Validation Contract Annex
  http://www.icasc.co/sites/faa/uploads/documents/Library/ICASC/ICASC_FIS_Contract__Annex_v0_2_26_05_2016_final101.pdf

- Reference Note ~~note~~ from ICAO on the Considerations ~~considerations~~ of Radio ~~radio~~ Navigation ~~navigation~~ Aids ~~aids~~ Flight ~~flight~~ Inspection ~~inspection~~ Periodicity ~~periodicity~~
  https://www.icao.int/safety/OPS/OPS-Normal/Pages/Flight-inspection-for-radio-aids.aspx

– – – – – – – – – – – – –

App-2 Appendix 2

1.2. Among the numerous requirements from the International Civil Aviation Organization (ICAO), flight navigation systems must be regularly calibrated, inspected and maintained to ensure that all essential navigation aids for pilots are always working properly. This means that these systems must be tuned and maintained to radiate the correct signals in the airspace, at any time. To achieve this, a combination of ground and air inspections is necessary, like the localizer measurements for CAT III ILS ~~(Instrument Landing System)~~.

1.3. ILS is an essential navigation aid to help pilots land their aircraft in low visibility conditions during IFR ~~(Instrument Flight Rules)~~ flights. In order to maintain the ICAO ILS certification, dynamic measurements need to be performed by the airport operators / ANSPs, their subcontracted flight inspection organizations or government agencies. These companies are always looking to improve and streamline inspection processes to mitigate impacts on airport operations. The regular ILS signal inspection is made in flight, using a manned aircraft. It requires prior coordination and preparation with various stakeholders, together with ground measurements in order to optimize the manned flight inspection.

3.1. ~~As in 2019, f~~Flight inspection organizations or institutes in Belgium, China, Germany, Italy, Russia, Spain have used drones to assist and provide supplementary tests in flight inspection works. The drones are normally be used to assist testing of navigation equipment signals, since they are not competent for all flight inspection missions with limited performance in speed, service ceiling, endurance, crosswind resistance, payload, etc. Some latest developments on technology and standard shared by States/organizations are listed below for reference:

3.4. China

(a) In CNS/SG/25 meeting, China has shared their trials and application of UAS as well as the progress of standards development. Some reference materials contributed by China are summarized below for reference:

i) UAS-Based PAPI Inspection Technology in China
https://www.icao.int/APAC/Meetings/2021%20CNS%20SG%2025/WP24_CHN%20AI.12%20-%20UAS-based%20PAPI%20Inspection%20Technology%20in%20China.pdf

ii) Standard Establishment of UAS-Based Flight Inspection System in China
https://www.icao.int/APAC/Meetings/2021%20CNS%20SG%2025/Flimsy%2003_CHN%20AI.12%20-%20Standard%20establishment%20of%20UAS-based%20flight%20inspection%20system%20in%20China.pdf

iii) Standard Establishment of Data Link for UAS-Based Flight Inspection in China
https://www.icao.int/APAC/Meetings/2021%20CNS%20SG%2025/IP15_CHN%20AI.12%20-%20Standard%20Establishment%20of%20Data%20Link%20for%20UAS-based%20Flight%20Inspection.pdf