



ASSEMBLY — 42ND SESSION

TECHNICAL COMMISSION

Agenda Item 24: Aviation Safety and Air Navigation Priority Initiatives

**PROPOSAL FOR THE DEVELOPMENT OF WORLDWIDE SARPS AIMED AT
INTEGRATING ARTIFICIAL INTELLIGENCE INTO FATIGUE RISK MANAGEMENT
SYSTEMS FOR AIR TRAFFIC CONTROLLERS**

(Presented by Morocco)

EXECUTIVE SUMMARY

This working paper proposes integrating artificial intelligence (AI) technologies into fatigue risk management systems (FRMS) for air traffic controllers (ATCOs). Pursuant to the provisions of ICAO Annex 11 — *Air Traffic Services* and *The Manual for the Oversight of Fatigue Management Approaches* (Doc 9966), this approach aims at strengthening the detection, prediction and prevention of fatigue-related risks, using dynamic and personalized tools. Such a development would enhance operational safety while safeguarding the fundamental rights and welfare of controllers.

Action: The Assembly is invited to:

- a) request ICAO to undertake a study on the integration of artificial intelligence into the FRMS for ATCOs;
- b) encourage the development of guidelines and, if necessary, SARPs to regulate such integration;
- c) urge States and service providers to conduct pilot projects and to share lessons learned within ICAO; and
- d) recommend the adoption of an oversight framework based on performance, algorithmic transparency and staff participation criteria.

<i>Strategic Goals:</i>	This working paper relates to <i>Every Flight is Safe and Secure</i> .
<i>Financial implications:</i>	Initial costs related to pilot projects, data collection and training.
<i>References:</i>	Annex 11 – <i>Air Traffic Services</i> Annex 19 – <i>Safety Management</i> Doc 10004, <i>2026-2028 Global Aviation Safety Plan</i> Doc 9966, <i>Manual for the Oversight of Fatigue Management Approaches</i> Doc 9750, <i>Global Air Navigation Plan</i>

¹ French version provided by Morocco.

1. INTRODUCTION

1.1 Fatigue is a well-documented risk factor in the field of air traffic services. The current FRMS still rely mainly on predefined duty time limits and self-declarations.

1.2 Artificial intelligence offers new possibilities for making these systems more predictive, adaptable and personalized, in line with the principles of safety management systems (SMS) and human performance considerations.

1.3 This working paper proposes that ICAO develop harmonized guidance or SARPs to guide States on integrating AI into FRMS, while ensuring adherence to strict ethical and legal standards.

2. DISCUSSION

2.1 Limits to current FRMS

2.1.1 Most FRMS currently in effect rely on rigid approaches (time slots, regulatory rest periods) without integrating real-time data.

2.1.2 Personal differences in terms of sleep, mental workload or resilience to stress are not systematically taken into account.

2.1.3 The lack of objective and continuous indicators frequently delays the identification of real operational fatigue.

2.1.4 Several States or providers lack technical resources to develop advanced FRMS.

2.2 Potential benefits of AI

2.2.1 AI would enable the use of biometric data (cardiac rhythm, ocular motility, sleep cycles), work schedules and traffic loads to detect the risks of fatigue.

2.2.2 Learning algorithms could anticipate risk periods and propose personalized staff rotations.

2.2.3 Individual fatigue profiles could be established, allowing for targeted and minimally invasive recommendations.

2.2.4 Visualization tools could help supervisors take enlightened decisions in real time.

2.2.5 Several States, including the United States and Japan, have already undertaken AI experiments on air controller fatigue management.

2.2.6 The use of artificial intelligence to detect and manage fatigue is already well established in other critical sectors. In the area of railway transport, some companies are using AI to monitor train engineers' alertness in real time via ocular sensors and predictive algorithms. In the hospital environment, staff planning tools include fatigue indicators to minimize errors associated with long working hours.

2.3 **Risks and considerations**

2.3.1 Protection of personal data : provisions should have sound legal basis.

2.3.2 Algorithmic transparency : any models used should be understandable, verifiable and audited.

2.3.3 Human prevalence: AI should support, but not be a substitute for, professional judgment.

2.3.4 Social and ethical acceptability : personnel engagement through training, dialogue and transparency is essential.

2.4 **Need for a coordinated approach**

2.4.1 An ICAO-led initiative would enable States to experiment with AI solutions in the context of monitored pilot projects.

2.4.2 A technical expert group of the Air Navigation Commission could propose performance criteria and regulatory guidelines.

2.4.3 Close collaboration among States, service providers, industry and academia is necessary to ensure consistent and acceptable deployment.

2.5 **Proposed framework**

2.5.1 Establish a technical subgroup under the relevant panel, composed of :

- a) States that have implemented advanced FRMS or experimented with artificial intelligence in operational environments ;
- b) Experts in artificial intelligence, behavioural sciences and human performance, as well as representatives of regional organizations and air navigation service providers (ANSPs) ;
- c) Specialists in data protection, digital ethics and labour law, in order to ensure a framework that is balanced and respectful of fundamental rights and good practices.

2.5.2 Develop SARPs or guidelines defining minimum performance requirements for the integration of AI into FRMS, including algorithmic transparency, validation of tools, data governance and oversight responsibilities.

2.5.3 Require suppliers of technological solutions to publish standardized technical and functional criteria concerning the use of AI in alertness monitoring devices, fatigue prediction tools and operational planning recommendation systems to ensure their interoperability, auditability and alignment with safety objectives.

3. **CONCLUSION**

3.1 Artificial intelligence presents a sizable opportunity to advance fatigue management systems in ATS services.

3.2 ICAO has a leading role to play in supporting States to ensure a responsible, safe and efficient adoption of these technologies.

3.3 A gradual approach that is guided by ethics and based on scientific assessment and consultation will yield positive results in terms of safety, resilience of services and staff welfare.

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