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PREVENTION OF FATIGUE IN AVIATION TECHNICAL AND MECHANICAL PERSONNEL FOR THE CONTINUOUS IMPROVEMENT OF SAFETY

(Presented by the International Transport Workers' Federation)

EXECUTIVE SUMMARY

This working paper informs about the existing relationship between maximum working hours and minimum rest periods for aviation technical and mechanical personnel and the potential to safety consequences, highlighting fatigue as a critical operational risk that directly affects aeronautical maintenance safety. Human factors and existing ICAO and ILO regulatory frameworks are examined, demonstrating that cost reduction through extended working hours represents a false economy that compromises safety. Recommendations are presented to Member States to strengthen their regulatory frameworks, implement fatigue risk management systems (FRMS) and foster a safety culture centred on staff well-being.

This is an Information Paper which does not require further actions from the Assembly.

<i>Strategic Goals:</i>	This working paper relates to <i>Every Flight is Safe and Secure, The Economic Development of Air Transport Assures the Delivery of Economic Prosperity and Societal Well-Being for All</i> and <i>Aviation Delivers Seamless, Accessible, and Reliable Mobility for All</i> .
<i>Financial implications:</i>	This Information Paper does not imply any direct financial implications for ICAO.
<i>References:</i>	Annex 6 – <i>Operation of Aircraft</i> Annex 8 — <i>Airworthiness of Aircraft</i> Annex 19 – <i>Safety Management</i> Doc 9966, <i>Manual for the Oversight of Fatigue Management Approaches</i> Doc 10004, <i>Global Aviation Safety Plan</i> ILO Guidelines on Occupational Safety and Health Management Systems (ILO-OSH 2001) ILO conventions and declarations on working conditions and fatigue prevention Studies and reports on human factors and aircraft maintenance published by ICAO

¹ English and Spanish versions provided by ITF.

1. INTRODUCTION

1.1 The International Civil Aviation Organization (ICAO) is committed to the continuous improvement of safety, with the aspirational goal of achieving and maintaining zero fatalities in commercial air transport by 2030 and beyond. Key strategic pillars supporting this objective include the safety management system (SMS) and the *Global Aviation Safety Plan* (GASP, Doc 10004)). Since the entry into force of Annex 19 – *Safety Management* to the Chicago Convention, safety management has been formally recognised as a shared responsibility between States and service providers, requiring the implementation of systems and processes to proactively identify, mitigate and control critical operational risks.

2. DISCUSSION

2.1 Safety is a dynamic state in which the risks associated with aviation activities must be continuously reduced and controlled to an acceptable level. The evolution of safety practices has increasingly acknowledged the importance of human factors, extending beyond purely technical and institutional considerations. Human performance is subject to significant variability due to internal influences such as fatigue. The effectiveness of safety management relies heavily on the active support and commitment of senior leadership to foster a working environment that promotes and sustains optimal human performance.

2.2 Fatigue is a hazard that can result in "actions taken or not taken" (active failures) by front-line personnel, such as aircraft maintenance technicians, which have "immediate adverse effects" and may "produce harmful outcomes". This risk also extends to personnel involved in indirect maintenance tasks, such as aeronautical engineers, whose responsibilities include analysing and adapting complex technical documentation or providing remote support in resolving faults with major safety implications.

2.3 Optimal human performance is essential to ensuring safety. Fatigue directly impairs the accuracy, decision-making ability and situational awareness of technicians, engineers, and mechanics, which increases the likelihood of errors during critical maintenance activities, ranging from incorrect component installation to procedural non-compliance or the failure to detect anomalies, with serious consequences for airworthiness and overall flight safety.

2.4 The pursuit of operational efficiency and cost reduction, often reflected in extended working hours and reduced rest periods, is an economic fallacy when viewed through the lens of safety. While investments in "protection" (safety measures) entail costs, they can enhance "production" by reducing the occurrence of accidents and incidents, along with their associated costs.

2.5 For maintenance organisations, the pressure to extend working hours and limit rest in an effort to reduce labour costs is a false economy. A single catastrophic event can have devastating consequences, not only in terms of human lives, but also through the potential financial collapse of the organisation and the erosion of public confidence in aviation safety.

2.6 The SMS requires a proactive approach to risk management. Hazard identification must be continuous and grounded in data collected from multiple sources. ICAO underscores the importance of data-driven decision-making (D3M) to ensure the effective allocation of resources and the continuous

improvement of safety performance. Achieving this goal depends on the availability of “reliable safety data and information”.

2.7 Annex 19 establishes the requirements for SMSs across service providers, including approved maintenance organisations. In this context, the *Manual for the Oversight of Fatigue Management Approaches* (Doc 9966) offers essential guidance. Implementing an appropriate fatigue risk management system (FRMS) for maintenance personnel directly supports ICAO’s objective of enhancing safety planning and performance.

2.8 The International Labour Organization (ILO) has determined that “excessive working hours and inadequate rest and recovery periods” are crucial issues that can be “harmful to workers’ health and increase the risk of occupational accidents”. This statement, from the first ILO Convention in 1919, underscores its foundational role in international labour law. In 2011, it also defined an international standard on the basic components of an SMS through the document “ILO-OSH 2001 Guidelines on Occupational Safety and Health Management Systems”, demonstrating a conceptual alignment between safety management and occupational health and safety.

2.9 ICAO Member States are urged to adopt the following recommendations:

2.9.1 States should develop and enforce prescriptive regulations defining maximum working hours and minimum rest periods for aviation technical and maintenance personnel due to their direct impact on safety, similar to those existing for flight and cabin crews. These regulations should be based on scientific principles, knowledge and operational experience regarding fatigue.

2.9.2 National legislation should explicitly recognise fatigue as a critical operational risk in aviation maintenance and establish the legal framework for its systematic management within the SMSs of maintenance organisations. It should also mandate that maintenance organisations implement a fatigue risk management system (FRMS) as an integral component of their SMS.

2.9.3 State safety inspectors must receive adequate training to evaluate the effectiveness of FRMSs and fatigue controls within maintenance organisations. They should also be equipped to implement training and education programmes addressing the effects of fatigue, its symptoms and mitigation strategies for all maintenance personnel.

2.9.4 Promote a “positive safety culture” by fostering an environment of trust that encourages technical personnel to report fatigue-related incidents without fear of reprisal, while ensuring the protection of safety data and information and the respective sources. Encourage the exchange of information and best practices on fatigue management in maintenance among Member States and industry, including through regional aviation safety groups (RASGs).

2.9.5 States must ensure that safety oversight authorities and maintenance organisations are adequately resourced, both financially and with qualified technical personnel, to implement and sustain effective fatigue management programmes.

3. CONCLUSION

3.1 The effective integration of maximum working limits and minimum rest periods, alongside the implementation of robust fatigue management systems for aviation technical and

mechanical personnel, is an essential element in realising ICAO's vision of "zero fatalities in commercial operations". By prioritising the well-being of these professionals, Member States not only uphold their international labour commitments but also strengthen the inherent safety of the aviation system, reduce operational risks and prevent the devastating costs associated with accidents. It is crucial for the aviation community to acknowledge that investing in fatigue management is a direct investment in the safety, resilience and sustainability of global civil aviation.

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