



# IEAG INSIGHTS

## FATIGUE IN THE AIRCRAFT MAINTENANCE ENVIRONMENT

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Our goal with this feature is to showcase our knowledge and expertise for the benefit of our readers. We've been serving a vast roster of aviation industry clients for more than 60 years – and we are looking forward to sharing various key lessons learned with you. Our Insights series will offer best practices and gained know-how, practical guidance and advice, and will help educate and inform in various areas of interest to our aviation community as we move forward. Please don't hesitate to reach out with comments and feedback at [insights@innotech-exECAIRE.com](mailto:insights@innotech-exECAIRE.com) so that we can serve you better.

# FATIGUE IN THE AIRCRAFT MAINTENANCE ENVIRONMENT

As far back as 1997, the NTSB recommended that the Federal Aviation Administration “Review the issue of personnel fatigue in aviation maintenance; then establish duty time limitations consistent with the current state of scientific knowledge for personnel who perform maintenance on air carrier aircraft” (NTSB, 1997).

Maintenance personnel fatigue is a serious issue and certainly top of mind for IEAG's **Director of Maintenance George Zarikos**, who points out fatigue risk management has typically focused on continuous control tasks, such as operating an aircraft, with falling asleep being the main threat. “From a maintenance



perspective, sleep (or a micro-sleep), is not the threat—but rather errors caused by impaired mental functioning, such as FOD left in an engine, missing steps in a repair process, unsecured access panels/cowlings, fitting of wrong parts, etc., all of which could have serious consequences.”

## Fatigue Risk Management Systems

Fatigue Risk Management Systems have been promoted by the FAA, ICAO, EASA, Transport Canada, and others. Although the FAA established the initial Human Factors for Aviation Maintenance training in 1988, it took a major tragedy to bring about greater interest from regulatory bodies. “As such, regulatory bodies

have not yet mandated measures for fatigue management among aircraft maintenance personnel, though many organizations, Innotech ExECAIRE among them, feel this is a necessary next step,” says Zarikos.

“This leaves maintenance organizations responsible for implementing their own strategies, be it via existing Safety Management System (SMS) or through a stand-alone Fatigue Risk Management System (FRMS).”

The FAA has defined FRMS as “A data-driven and scientifically-based process that allows for continuous monitoring and management of safety risks associated with fatigue-related error. It is part of a repeating performance improvement process. This process leads to continuous safety enhancements by identifying and addressing fatigue factors.”

## What are the contributing factors to fatigue?

As Zarikos points out, “Risk of fatigue resides in nighttime work and rotating shift work along with the possibility of long and unregulated duty times. This, coupled with the resulting sleep disruption and cumulative sleep deficit, lead to impaired judgment, difficulty focusing attention, memory lapses, reduced

mood and motivation and other effects on performance. Ultimately, the cause of fatigue is a combination of elements, related to both the work environment and personal factors.”

When asked about what an effective FMRS should cover, Zarikos states that “An effective FRMS is one that encompasses company policies, incident reporting, analysis, proactive risk assessment, and open communications between employees and management contributes to a culture of safety.”

At IEAG, our FRMS model calculates positive points for rest and negative points for fatigue within a 24-hour projected window for specific maintenance jobs. The summary calculation of the fatigue factor takes into account commuting times, when the request came in for additional work and the maximum number of straight hours that





can be worked. “If the model gets to a positive number that mitigates the fatigue factor at its maximum, then the work can continue. If not, we send the person home to rest,” Zarikos explains.

Through the development of IEAG’s FRMS, Zarikos and his team have identified some of the root causes of fatigue and how those causes can lead to maintenance errors. One was ensuring that shift lengths are eight hours and that anything beyond that requires special consideration and evaluation, while the second was making it mandatory to declare entering an area of fatigue. “It’s a question of adopting fatigue management as an element of our culture,” says Zarikos.

IEAG put its FRMS in place for two main reasons: to build a holistic safety culture and ensure best-in-class manpower planning. “We have an in-depth understanding of how fatigue factors influence performance—and we leverage that understanding to improve safety,” he explains.

Zarikos notes that although some airlines have begun to account for fatigue in their maintenance personnel, this is not an across-the-board adjustment for all aircraft owners, operators and airlines. “But it is the right thing to do, and something the regulatory bodies should make mandatory. There’s no other option,” he says. “We already know that shift work presents its own specific challenges, so we’ve learned how to manage that alongside challenges like unexpected workloads, clients with drop-in demands and aircraft-on-the-ground (AOG) work.” Here, Zarikos is referring to the complex matter of shift rotations, which already interfere with the body’s acclimation to patterns. Unexpected work can throw off even the best-laid plans, having the potential to keep maintenance crews on duty many hours beyond their shifts, resulting in the profound fatigue that could cause maintenance errors.



“Our industry is based on cross-pollination – for safety especially. We all learn from each other. While we wait for the regulatory bodies to make managing fatigue in our environment mandatory, we hope that other companies will follow us on the path of fatigue measurement and prevention. We can only evolve by collecting more data and then together, we can create an even more robust FRMS for maintenance – for everyone.”