

Tenth International Conference on Managing Fatigue: Abstract for Review

Fatigue in a regional aircraft operator: the effect of multi-segment operations in alertness

Pedro Alc eu; Lusofona University, Department of Aeronautics and
Transportation, Lisbon, Portugal; pedro.alceu@tap.pt (Corresponding author)

Anabela Sim oes; Lusofona University, Department of Aeronautics and
Transportation, Lisboa, Portugal; p901622@ulusofona.pt

Jos e Carvalhais; Faculdade de Motricidade Humana, Universidade de Lisboa,
Portugal; Centre for Architecture, Urban Planning and Design (CIAUD),
Universidade de Lisboa, Portugal; jcarvalhais@fmh.ulisboa.pt

Problem

With the economic changes in recent years, airline managers face the need to optimize resources to reach profit and reliability targets. This leads to higher utilization of commercial aircrews, more hours of work, and consequently less sleep and off time. As such, aircrews face an increase in frequency of sleep disturbances, alertness impairments and reduced on-job performance. Fatigue has recently been addressed by several studies and documents, proving to be a hazard with risks to flight safety. The main goal of this study was the identification of fatigue in a regional aircraft operator that has a major rostering structure of multi-flight operations in the early hours of the day (before 09 a.m.).

Method

This research has been conducted in a regional airline that operates a fleet of seven turboprop aircraft, divided into two sub-fleets. The main commercial focus is the connections between nine islands situated approximately two flying hours away from mainland. Their longest flight is approximately 02h00 long and the shortest 15 minutes total time. The population in the study corresponds to 52 airline pilots, 27 Captains and 25 First Officers, all male and with an average age of 39.2 (\pm 9.539) years old (ranging from 30 to 63). The methodology consists of

two interconnected procedures to analyze fatigue factors related to the existing working conditions: (1) hours of work analysis in planned pilot's rosters to identify fatigue hotspots; (2) measurement of individual subjective fatigue using a 3-week survey distributed daily in live flight operations. This survey allowed the measurement of individual fatigue in the beginning of the working day and at top of descend (TOD) on the last flight of the day through the Samn-Perelli fatigue scale (SP) and the Karolinska sleepiness scale. A generic lifestyle questionnaire was also distributed to identify any variability factors that could influence the measurements and further limit pilot's performance.

The results were achieved through a methodic approach to schedule analysis by first processing one year of planned pilot rosters to identify areas of potential fatigue risk (early hours of the morning, late hours in the evening and working days with more than 4 flights) and then by comparing reported pilot values in the start and the end of a working day.

Results

There were significant differences in minimum and maximum monthly working hours per pilot (min. 27h, median 88h, max. 159h). Analysis of 8100 duties (a one year roster period) revealed a significant amount of duties (47.3%) starting in the early hours of the day and encompassing the highest average duty lengths and number of flights flown. More than 50% of the flights in this period had up to 8 sectors (average of 6), with the very early hours (before 07:30 a.m.) combining averages of 08 hours of duty and 06 sectors.

Survey results on the live study were obtained from 128 different trips corresponding to 240 pilots. Start times varied from 06 a.m. (N=14) to 07:30 p.m. (N=2), with 41% starting before 09 a.m.. Individuals reported being fully alert, wide awake (SP=1) as minimum fatigue levels at both sign on (N=55) and TOD (N=11). Some pilots reported as being moderately tired, let down (SP=5, N=11) as maximum value on the start of the working day and as being extremely tired, very difficult to concentrate (SP=6, N=11) at TOD. There was a positive correlation between number of flight sectors in a day and the increase in sleepiness, $r(240) = .307$ ($p < 0.005$), as well as between number of flights operated and the increase in fatigue, $r(240) = .197$ ($p < 0.005$). There was a

greater gap in the difference between reported alertness at sign-on and TOD on duty days with 4 or more landings in a single day..

Discussion

The study was conducted in a regional aircraft operator that, due to its route structure, incorporates a high percentage of very short flights (under 1h) in a potentially challenging and demanding environment.

Age has an influence in sleep and alertness, so the young average age of pilots represents a hazard and fatigue factor in the coming years.

Distribution of monthly working hours is uneven and a risk factor, suggesting that there could be relevant variations in alertness between individuals due to higher cumulative sleep debt, accumulated stress and tiredness. A thorough detailed analysis should be made to better understand the gaps between minimum and maximum values, improving roster fairness and quality.

Results showed evidence of higher fatiguing days when a duty is initiated in the early hours of the morning. Working days starting up to 07:30 a.m. represent 25% of the operation with most pilots reporting fatigue values above SP 4 (a little tired, less than fresh). The relation between fatigue, sleepiness the number of flights operated in a single duty represent the problematic of operating multi-sector duty days. This is further demonstrated by the high fatigue increases between reported values at the start and end of a working day, mostly as a consequence of the number of sectors flown.

Workload caused by multi-segment operations might be a potential hazard and must be considered as a fatigue factor. Results prove that it is important to setup a fatigue management plan to mitigate decreases in alertness and consequently reduce risk in flight operations.

Summary

Fatigue is a hazard to flight operations. The early start time of the duty day has a negative influence in alertness, with the number of sectors flown further aggravating sleepiness and consequently a reduction in alertness. Workload is also a factor that has a significant impact in the individual state of fatigue and should be further analyzed and discussed in regional aircraft operations, especially when the duty day encompasses four or more landings. It is important

to setup new hazard identification and risk mitigation processes, joining flight safety and rostering departments in better and more robust crew schedules, guaranteeing increased safety levels and better Human performance in overall flight operations.