

Impact of Fatigue Related Scheduling Factors on Sleepiness in Aviators

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*Posthumously



INTRODUCTION

- Pilot fatigue associated with circadian rhythm disruptions and disturbances of sleep/wake cycle is of concern in aviation operations
- Crew members are often required to work irregular schedules, regardless of their geographical location. As a result, flight crew can experience sleep loss and alertness decrements.
- The present study investigated:
 - potential fatigue factors experienced by domestic and international pilots, as driven by operational demands
 - scheduling factors that are considered by pilots when bidding for monthly schedules

METHODS

Survey

- 44-item anonymous survey, completed voluntarily
- Developed to assess fatigue and scheduling factors associated with commercial airline flight schedules
- Administered to different airlines locations using either website or paper-and-pencil format
- Data collected from July 2002 - January 2004

Participants

- N = 448 current air transport pilots
- Crew base: n = 120 U.S.; n = 325 non-U.S.; n = 3 unidentified

U.S. pilots:

- Gender: 108 male, 12 female
- Age: $M = 46.93$, $SD = 7.14$
- Flight position: captain (n = 65), first officers (n = 39), flight engineers/ second officers (n = 12), unidentified (n=4)

Non-U.S. pilots:

- Canada (n = 89), Spain (n = 181), and Italy (n = 55)
- Age: $M = 41.45$, $SD = 8.56$
- Gender: 314 male, 11 female
- Flight position: captain (n = 160), first officers (n = 162), flight engineers/ second officers (n = 3)

Analyses

- One-way MANOVA was conducted to test the differences between U.S. pilots and non-U.S. pilots on:
 - Fatigue factors (n = 5; listed in Fig. 1)
 - Importance of factors when bidding for monthly schedule (n = 13, listed in Table 1)
- Independent t-tests were performed for comparisons between U.S. and non-U.S. pilots for flight hours, duty days, and duration.

TABLE & FIGURES

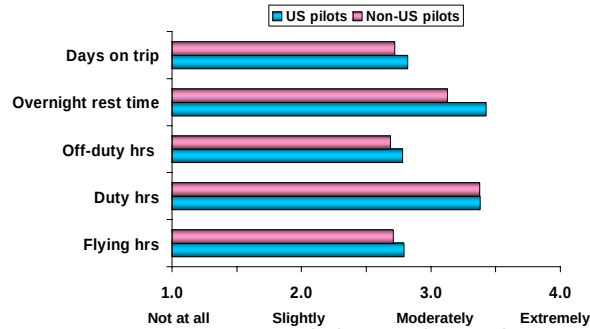


Figure 1. Factors that affect fatigue levels on trips

Table 1. Factors that are of importance when pilots bid for their monthly schedule assessed on a 4-point Likert-type scale from "Not at all" to "Extremely".

FACTORS	US		NON-US		F(1, 433)
	M	SD	M	SD	
Fatigue due to duty time length	2.37	0.96	2.62	0.92	5.77*
Fatigue due to multi-day trips	2.35	1.04	2.59	0.97	4.61*
Fatigue due to timing of the flights	2.61	1.09	2.88	0.94	6.43*
Fatigue due to short breaks between trips	2.25	0.98	2.41	0.99	2.02
Total days off in a month	3.38	0.72	3.01	0.93	14.95***
Continuous days off	3.22	0.86	2.88	0.95	10.73***
Particular days off (weekends, holidays)	3.1	0.88	2.84	0.98	6.05*
Estimated chance of getting scheduled bid	2.35	0.97	2.57	0.93	4.41*
Timing of the flights relative to daily family schedule	2.11	1.02	2.68	1	26.33***
Timing of the flights relative to commute to the airport	2.15	1.09	2	1.01	1.92
Destinations	2.64	0.81	2.53	0.86	1.24
Pay	2.78	0.96	2.17	0.89	37.70***
Flight hours	2.58	0.96	2.37	0.83	5.07*

* $p < .05$, *** $p < .001$

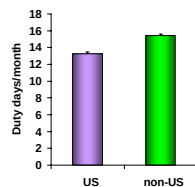


Figure 2. The typical duty days per month for U.S. pilots and non-U.S. pilots

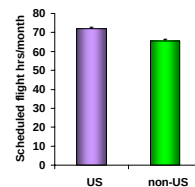


Figure 3. The typical number of scheduled flight hours per month for U.S. and non-U.S. pilots

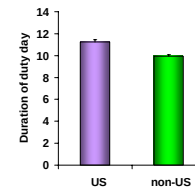


Figure 4. The typical duration of the duty day for U.S. and non-U.S. pilots

RESULTS

One-way MANOVA to test the differences between U.S. pilots and non-U.S. pilots on:

Fatigue Factors:

- significant difference between the two groups on the five factors related to fatigue and duty time (Wilks' Lambda = .974, $F(5,433) = 2.27$, $p < .05$)
- significant main effect of the overnight rest time ($F(1,437) = 10.49$, $p < .001$) with the U.S.-based pilots being more affected than the non-U.S.-based pilots (see Figure 1)

Importance of factors when bidding for a monthly schedule:

- significant difference between the two groups on the 13 factors that are of importance when bidding for a monthly schedule, Wilks' Lambda = .784, $F(13,421) = 8.90$, $p < .001$
- significant main effects of various factors are shown in Table 1

Independent t-tests to test the differences between U.S. pilots and non-U.S. pilots on:

- The typical number of duty days per month: $t(345.41) = 7.12$, $p < .001$ (Figure 2)
- The typical number of scheduled flight hours per month: $t(339.56) = 5.24$, $p < .001$ (Figure 3)
- The typical duration of the duty day: $t(441) = 5.48$, $p < .001$ (Figure 4)

CONCLUSION

- Results suggest that U.S.-based pilots report being sleepier than non-U.S.-based pilots, which may be due to less time off between scheduled trips, not allowing for sufficient recovery sleep
- Results show that when bidding for monthly schedules, the U.S. pilots are considering factors such as the number and the type of days off in a month, pay, and flight hours, while the non-U.S. based pilots consider more important the duty time length, multi-day trips, timing of the flights, and timing of the flights relative to daily family schedule
- Although the U.S. pilots have less duty days in a month, they have more scheduled flight hours per month, and the duty day is longer compared to non-U.S. pilots
- Research has shown that longer duty hours lead to increase in performance decrements that would further lead to an increased risk of accidents

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