Congressionally Directed
FAA Research on Flight Attendant Fatigue

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2004 DOT Appropriations Bill (House Rpt. 108-671)

1.1 “…to better understand the impact of the minimum rest requirements of FAR 121.467 and FAR 135.273, the Committee recommends…a study of flight attendant fatigue…The study should [include]…the agency’s recommendations on potential regulatory revisions.”
2005 Study Approach

NASA Ames Research Center’s Fatigue Countermeasures Group conducted study with CAMI oversight and assistance

Approach:
1) Literature review on flight attendant (FA) fatigue
2) Query fatigue-related incident/accident data (Aviation Safety Reporting System and NTSB databases)
3) Evaluate current duty schedules and compare with the current regulations (various carriers)
4) Apply performance and fatigue models to scheduling data sample
2005 Study Recommendations

1. Survey of Field Operations
   To assess the frequency with which fatigue is experienced, the situations in which it appears, and the consequences that follow

2. Field Research on the Effects of Fatigue
   To explore physiological and neuropsychological effects of fatigue, sleepiness, circadian factors, and rest schedules on flight attendants

3. Validation of Models for Assessing FA Fatigue
   An important step to understanding whether and how models could be used in conjunction with field operations
2005 Study Recommendations (cont)

4. Focused Study of Incident Reports
   *To better understand details of the incidents*

5. International Carrier Policies and Practices Review
   *To learn how other countries address these issues and with what results*

6. Training
   *Flight Attendant Fatigue, AM-07/21
   *FAs could benefit from information on fatigue, its causes and consequences, its interaction with circadian disruption, and how and when to employ countermeasures (e.g., scheduled naps, physical activity, social interaction, caffeine)*
FY-08 Omnibus Spending Bill

“…the Committee directs CAMI to [conduct] analysis in the six areas [including] a survey of field operations, a focused study of incident reports, field research on the effects of fatigue, a validation of models for assessing flight attendant fatigue, international policies and practices, and the potential benefits of training.”
Part I: Survey of Field Operations

Coordinated with management and labor for focused assistance in accomplishing the Survey and Field Study/modeling projects

ATA    Air Transport Association
RAA    Regional Airline Association
AFA    Association of Flight Attendants
APFA   Association of Professional Flight Attendants
TWU    Transport Workers Union
IAMA   Int’l Assoc of Machinists & Aerospace Workers
USW    United Steel Workers

Non-Unionized Airlines
Part I: Survey Methods

Retrospective survey

- 124 questions
- 30 operators (regional = 17, low-cost = 7, and network = 6)

Survey addressed:

- Work background
- Duty time & workload
- Sleep demographics (home and away)
- Health
- Fatigue
- Work environment
- Demographic information
Part I: Survey Sample

- Active flight attendants w/in FAA Civil Aviation Registry
- 20,826 surveys distributed
- Voluntarily and anonymously returned
  - 10,550 completed surveys (online = 4,571; paper = 5,979)
  - 51% overall response rate
- Good representation across demographics and reflective of workforce
- Of those, 9,180 (online = 4,039; paper = 5,141) met inclusion criteria
  (i.e., employed as active flight attendant w/current airline at least 1 mo & flown w/in previous bid period)
  - resulting in a 44% adjusted response rate
Part I: Survey Results & Recommendations

“Flight Attendant Fatigue Part I: National Duty, Rest, and Fatigue Survey” (Avers, King, Nesthus, Thomas, and Banks)

Recommendations:

Scientific examination of duty duration, continuous-duty overnights, reserve practices, reduced rest, breaks, rest periods, and duty report times

Identification of ways to improve schedules from a science-based approach to maximize alertness and minimize fatigue while meeting operational and economic constraints of the industry

Examination of nutrition during duty. Missed meals seem to be inherently tied to missed breaks or no breaks. Healthy meals can only be beneficial if there’s opportunity to eat

Implementation of comprehensive, science-based fatigue countermeasures training programs for flight attendants
Part IV: Focused Study of Incident Reports

NASA Aviation Safety Reporting System (ASRS) reports associated with fatigue among flight attendants between Jan 1990 and Dec 2007; resulted in 2,628 full-form reports

- CAMI reviewed each full-form narrative for common themes resulting in categories that could be considered either
  1) possible contributors to fatigue
  2) indicators of fatigue

- All report narratives reviewed and content analyzed using categories from Nesthus, et al. (2007) OAM report

- Additional information was requested from Event Review Committee (ERC) members of the flight attendant Aviation Safety Action Programs (ASAP)
Part IV: Results & Recommendations

“Flight Attendant Fatigue Part IV: Analysis of Incident Reports” (Holcomb, Avers, Dobbins, Banks, Blackwell, and Nesthus)

Recommendation:
Themes, in the incident reports analyzed, echoed issues raised in the survey and provide anecdotal support for the same recommendations

Part V: Review of International Policies and Practices

• CAMI reviewed domestic & international regulations, policies, and practices for fatigue management

• 38 regulations & 13 Collective Bargaining Agreements (CBAs) within & outside of U.S. from:

  1) Websites of 117 Int’l Civil Aviation Organization (ICAO) member states
  2) FAA International Field Offices
  3) International Cabin Safety Symposium
  4) ICAO Flight Safety Exchange Information announcement
  5) FAA Cabin Safety Aviation Safety Inspectors
Part V: Regulation & CBA Analysis

• Each regulation and CBA was content analyzed and a list of duty time & rest rules to manage fatigue was developed

• Each rule classified into four categories based on NTSB safety recommendations:
  1) Working hour limits
  2) Sleep & rest requirements
  3) Circadian rhythms
  4) Others (for rules that could not be clearly classified; e.g., commander’s discretion)
“Flight Attendant Fatigue Recommendation V: A Comparative Study of International Flight Attendant Fatigue Regulations and Collective Bargaining Agreements” (Banks, Avers, Nesthus, and Hauck)

Recommendations:
FAA should establish a Flight Attendant Fatigue workgroup of subject matter experts, aviation stakeholders, medical and research scientists, and aviation Safety Management System experts to evaluate 14 CFR sections 121.467 and 135.273 for possible revision

Develop an adaptive fatigue mitigation safety system, such as a Fatigue Risk Management System (FRMS), that combines scientific principles and knowledge with operational support and constraints
Part VI: Benefits of Countermeasures Training

• CAMI conducted an extensive review of the fatigue training literature to identify critical components of effective countermeasures training

• Programs have been implemented in aviation and other modes of transportation (e.g., railroad, trucking, water transport) for more than 20 years

• Countermeasures training educates workers on the biological drivers of circadian variation in alertness, sleep, and fatigue and offers personal strategies to increase alertness and mitigate the effects of fatigue during challenging schedules
Part VI: Countermeasures Training Methods

• Sample programs identified by:
  1) Search of scientific literature
  2) General search of public and private educational materials
  3) Personal inquiries with prominent fatigue researchers

• Training materials from diverse workforces content analyzed to develop basic outline of critical fatigue training topics

• Frequency index computed to determine commonality and criticality of topics

• Fatigue experts generally agreed on most important topics

• Topics were consistent across overall training programs & even more consistent among aviation-specific programs
Part VI: Results & Recommendations


Recommendations:

Airlines should implement fatigue countermeasures training covering topic areas documented in the report and tailored to the flight attendant population.

Training should be integrated into broader fatigue risk management strategies.

Parts II & III: Field Study & Modeling Project

• Field study requires most complex data collection
  • Sole source of objective data on sleep/wake patterns, cognitive performance, mood changes, and workload patterns of flight attendants as they progress through a normal duty & off-duty monthly work cycle

• CAMI initiated cooperative research agreement with nonprofit research organization (IBR) to conduct the project with field research experience

• CAMI worked extensively with airlines and flight attendant unions in protocol development and volunteer recruitment strategies
Current Status of Field Study & Modeling Project

• Participant solicitation began Feb-Mar 09
  • 5,000 interested FAs contacted website
  • 3,600 completed Pre-Study Questionnaire

• So far, data collected from 126 Flight Attendants between 5/25/09 and 11/18/09

• Data collection will continue through Spring 2010

• Model Validation
  • Pertinent measures will be entered into existing fatigue models, such as the Fatigue Avoidance Scheduling Tool (FAST™)
  • Scheduling data will be processed through the FAST™ to predict average day-to-day fatigue risk and its validity assessed against subjective and objective measures
Summary

• All human performance is vulnerable to sleep loss and daily variations in physiological and cognitive processes

• A greater understanding of Flight Attendant fatigue has been gained from these projects

• Though each of the completed studies suggest a need for review of flight attendant duty and rest regulations, the evidence necessary for decisions regarding regulatory change heavily depends upon objective data from the field study

• With consideration of implementing Fatigue Risk Management programs for flight attendants, predictive models useful for the FRMS process, may require additional validation
If time permits…

The following, are detailed slides associated with the field study and modeling efforts
Field Study Design & Methodology

Total Subject Pool
N = 210

Network Carriers n = 90
- Senior n = 30
  - Domestic n = 15
  - Intl n = 15
- Mid n = 30
  - Domestic n = 15
  - Intl n = 15
- Junior n = 30
  - Domestic n = 15
  - Intl n = 15

Low-Cost Carriers n = 60
- Senior n = 20
  - Domestic n = 15
  - Intl n = 15
- Mid n = 20
  - Domestic n = 15
  - Intl n = 15
- Junior n = 20
  - Domestic n = 15
  - Intl n = 15

Regional Carriers n = 60
- Senior n = 20
  - Domestic n = 15
  - Intl n = 15
- Mid n = 20
  - Domestic n = 15
  - Intl n = 15
- Junior n = 20
  - Domestic n = 15
  - Intl n = 15
Data Collection: Sleep & Activity Monitoring

- Pedometer (duty only)
- 24-hr/day Actigraphy

SleepBand (www.fatiguescience.com)
- Non-invasive
- Non-interactive
- Waterproof
- Experimenter controlled via IR-USB
Actigraphy Output Example Of 4 Days
Data Collection: Personal Digital Assistant (PDA)

- AT&T Tilt, Mobile Testing Suite (software developed by Peter Wubbels; www.archinoetics.com)
- Data downloaded via cell network following each testing session
Data Collection: PDA Daily Activity Log
Data Collection: Objective Performance Measures

- PDA Touchscreen-Based 5-min Psychomotor Vigilance Test (PVT)
- Participants responded with a screen touch when numerals appear
- Display of response time (42 ms in example) provided for each response
- Time between stimuli varied from 3-10 sec
Data Collection: Objective Performance Measures

Voice Recordings

- 5 randomly ordered fatigue-sensitive phrases designed and analyzed by Dr. Hal Greeley of Response Applications, LLC (hpg@responseapplications.com)
Data Collection: Subjective Reports

- Visual Analogue Scale (VAS)
  - Subjective fatigue and mood
  - NASA TLX (post-work)
  - Sleep Quality (post-sleep)
Thank you for not sleeping during this presentation.

Questions?

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