Identifying and Mitigating Fatigue as a Safety Risk

- Captain Brian Noyes, Member, Flight Time/Duty Time Committee, Air Line Pilots Association, Int’l
- Mr. Richard Lewis, Senior Manager, Crew Resource Planning and Analysis, FedEx Express
- Captain Chip Benton, Specialist- Crew Resources, United Airlines
- Captain Pat Hagerty, Fatigue Risk Management Committee Chairman
- Ms. Jodi Baker, Acting Division Manager AFS-200, Federal Aviation Administration
ALPA Flight Time Duty Time, Seminar
Identifying and Mitigating Fatigue as a Safety Risk

Presented to: ALPA 117 Seminar, Washington, D.C.
By: Jodi Baker, Manager, Air Transportation Division
FAA, Flight Standards
Date: November 2, 2016
In the Beginning

Triumph and success. In a moment captured for eternity by surfman John T. Daniels, Wilbur watches Orville make the first manned, controlled, sustained, heavier-than-air flight on Dec. 17, 1903, at about 10:35 a.m. local time. Distance covered: approx. 120 ft. Duration: 12 sec.
Impacts of Fatigue

- Reduction of speed and accuracy
- Lapses of attention and vigilance
- Impaired reasoning and decision-making, including reduced ability to assess risk
- Reduced situational awareness
- Low motivation to perform optional activities
14 CFR part 117
Types of Fatigue
Fatigue Contributors

- Time of Day
- Recent Sleep
- Individual Variation
- Time on Task
- Time Awake
- Cumulative Debt

Fatigue
Fatigue Mitigations in Part 117

<table>
<thead>
<tr>
<th>Transient</th>
<th>Cumulative</th>
<th>Circadian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fitness for Duty</td>
<td>Fitness for Duty</td>
<td>Fitness for Duty</td>
</tr>
<tr>
<td>FEAT</td>
<td>FEAT</td>
<td>FEAT</td>
</tr>
<tr>
<td>FDP Limits</td>
<td>FDP Limits</td>
<td>FDP Limits</td>
</tr>
<tr>
<td>FDP Extensions</td>
<td>FDP Extensions</td>
<td></td>
</tr>
<tr>
<td>Split Duty</td>
<td>CNO</td>
<td></td>
</tr>
<tr>
<td>Rest</td>
<td>Rest</td>
<td></td>
</tr>
<tr>
<td>Emergency Ops</td>
<td>Emergency Ops</td>
<td></td>
</tr>
</tbody>
</table>
Fatigue Risk Management Plan

14 CFR part 117
Elements of Fatigue Risk Management Plan

- Senior-level Commitment
- Policies and Procedures
- Fits within Part 117 or Part 121
- Rest Scheme
- Fatigue Reporting
- Education and Awareness Training Program
- Fatigue Incident Reporting
- System for Monitoring Flightcrew Fatigue
- FRMP Evaluation Program
Fatigue Risk Management Plan

14 CFR part 117

Fatigue Risk Management System
FRMS Process

The FRMS Process

a. Measure and Assess Current Conditions
b. Modeling and Analysis of Fatigue Risk
c. Manage and Mitigate Fatigue Risk
d. Assessment and Feedback
Thank You!

Questions?

Contact Information:

+ Jodi.L.Baker@faa.gov
ALPA Flight Time/Duty Time Conference
DCA
November 2/3, 2016
Fit For Duty - OR
Fatigued?
United Airlines FAR 117 Summary – 117 and FRMS

1) FAR 117 Statistics – Jan 2014 through Sep 2016 – 33 Months

<table>
<thead>
<tr>
<th></th>
<th>Jan 14-Sep 16</th>
<th>Avg per Month</th>
<th>% of Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flight Duty Periods</td>
<td>2,830,433</td>
<td>85,771</td>
<td>n/a</td>
</tr>
<tr>
<td>FDP Extensions</td>
<td>2,539</td>
<td>77</td>
<td>.090%</td>
</tr>
<tr>
<td>FT Exceedences</td>
<td>211</td>
<td>6</td>
<td>.007%</td>
</tr>
<tr>
<td>Total 117 Reportable Events</td>
<td>2,750</td>
<td>83</td>
<td>.097%</td>
</tr>
<tr>
<td>Fatigue Events</td>
<td>1,794</td>
<td>54</td>
<td>.063%</td>
</tr>
</tbody>
</table>

2) United Airlines – active FRMS authority
   a) Crew Rest on 777 and 747
   b) 737 Island Hopper – GUM-HNL-GUM
   c) California- SYD – includes LAX and SFO
   d) LAX-MEL
   e) SFO-SIN
   f) 3 pilot AMOC with AA for rest on 2nd break

3) FAR 117 – in 33 months
   Final Rule
   1 Clarification
   1 Safety Alert for Operators (SAFO)
   3 Corrections
   6 Advisory Circulars
   44+ Interpretations
Comparison of FDP / FTE events on days impacted by weather

<table>
<thead>
<tr>
<th>Count of FDP / FTE Events</th>
<th>Q3 2015</th>
<th>Q2 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>215</td>
<td>365</td>
</tr>
<tr>
<td>Days with Severe / Moderate Wx* Impact</td>
<td>110</td>
<td>245</td>
</tr>
<tr>
<td>Wx Impact</td>
<td>58</td>
<td>105</td>
</tr>
<tr>
<td>No Wx Impact</td>
<td>47</td>
<td>15</td>
</tr>
</tbody>
</table>

* 24 days had a severe or intermediate weather impact at one or more hubs

* 45 days had a severe or intermediate weather impact at one or more hubs
Driildown of 117 Reportable Events – Q3 2016

Of the 44 remaining events which reserve coverage indicates possible coverage existed,
- 36 events were primarily maintenance related
- 8 events were primarily weather/ATC related

Of the 36 maintenance related events – see mitigation discussion on next slide
- 12 aircraft swaps
- 12 single non-repeating events
- 10 gate returns
- 2 aircraft repositioning

<table>
<thead>
<tr>
<th>Category</th>
<th>Q3 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAA Reportable Events</td>
<td>365</td>
</tr>
<tr>
<td>Post Flight</td>
<td>(51)</td>
</tr>
<tr>
<td>Diversion</td>
<td>(46)</td>
</tr>
<tr>
<td>Non-Crew based</td>
<td>(78)</td>
</tr>
<tr>
<td>Taxi out exceedence</td>
<td>(40)</td>
</tr>
<tr>
<td>Remaining Events</td>
<td>150</td>
</tr>
<tr>
<td>Limited Rsv Coverage</td>
<td>(106)</td>
</tr>
<tr>
<td>Remaining events w/in United’s Control</td>
<td>44</td>
</tr>
</tbody>
</table>

* Some not yet reported as within our control
Corrective actions items implemented to date

- Increased FAR 117 visibility within operational groups – SMS/SAT/SRT
- Integrated Operations Monitor (IOM) – predictive view of operational day
- FAR 117 desk
  - One desk staffed 24/365
  - Second desk staffed during irregular and afternoon operations
- FAR 117 Training - Pilots, Schedulers, Dispatchers, Ops Managers, Management
- ACARS messaging to crews – Critical Crew Off Times
- Improved communications within the NOC between dispatch and the FAR 117 desk
- OM to verify OOOI time in CMS prior to operating flight for flights delayed over midnight
# 3Q 2016 FAR 117 Desk

<table>
<thead>
<tr>
<th>Action</th>
<th>2015</th>
<th>2016</th>
<th>% chg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operated</td>
<td>933</td>
<td>1,512</td>
<td>62.1%</td>
</tr>
<tr>
<td>Re-crewed</td>
<td>624</td>
<td>791</td>
<td>26.8%</td>
</tr>
<tr>
<td>Cancelled</td>
<td>147</td>
<td>154</td>
<td>4.8%</td>
</tr>
<tr>
<td>Ttl Managed</td>
<td>1,704</td>
<td>2,457</td>
<td>44.2%</td>
</tr>
</tbody>
</table>
Let’s Fly
Identifying and Mitigating Fatigue

Nov 2016
FedEx Express Flight Operations
By Numbers, Fleet and Operating Statistics

- 220 countries & territories
- 17,000 flights a month
- 10 global sort hubs
- 375+ airports
- 5 different aircraft types
- 340+ Aircraft

Operated by

- More than 4,300 Pilots
- 6 Crew Bases World Wide
Trip Variety

International Schedules
Time Zone Desynchronization

Number of Days
FRM Approach

- Model our program after the ICAO, IATA, IFALPA Fatigue Management Guide
- Develop the systems and processes required as if we were operating under full blown FRMS
- Pursue the science, become evidence based with data from our operations (Sleep Baselines)
- Determine fatigue risk based on objective data and experience
- Evolve the processes and automation
Identifying Fatigue Risk (Predictive Proactive and Reactive FRM)

Predictive FRM
- PSIT Review
- Fatigue Modeling
- Pairing Risk Analyzer
- DNA Pattern Analyzer

Proactive FRM
- Data Collection
- Data Analysis
- Self Reporting / Feedback
- Fatigue Surveys

Reactive FRM
- Fatigue Event Management
- Fatigue Reports
Fatigue Workbench

FEM • Fatigue Event Management
FDM • Fatigue Data Management
PRA • Pairing Risk Analyzer
FAM • FedEx Alertness Model
FDNA • DNA Pattern Analyzer
Centralized Fatigue Review Process

- Fatigue Event Management
- Fatigue Report Review
- New Proactive Fatigue Review
- Duty Extensions Review
Risk Assessment and Decision
Fatigue Working Groups

SIG
- Review pairing designs

FERC
- Reviews Fatigue Related schedules (Proactive/Reactive)

DCSC
- Manages Data Collection and presents to FRMG
- Works with PRPs

FRMG
- All Stakeholders
- Higher authority

• SIG  Scheduling Improvement Group
• FERC  Fatigue Event Review Committee
• DCSC  Data Collection Steering Committee
  - PRP  Primary Research Partners
• FRMG  Fatigue Risk Management Group
Mitigating Fatigue Risk

- Contractual Changes
  - 8-in-24 Designs, 32-in-120 Designs
  - Hub Nap Room (4h to 5h). Short-Long Design with Hub Turns

- Crew Rest Facility – Enhancement Project

- Wakeup Call Program

- Other Tactical Changes
  - Pairing Designs, Procedure Changes, CRS Best Practices
Improving Scheduling Rules

**Schedule Improvement Group (SIG)**
A cooperative effort between the company and ALPA to provide oversight in the monthly pairing and line construction process

**Scheduled Limits** – Apply to trips Inside 48 hours Domestic and 96 hours International

**Operational Limits** – Apply once the duty begins

**Federal Aviation Regulations** – FARs
Continue to Evolve Automation
Continue to improve the Science
Predicted vs Actual Sleep

No of Subjects (N)=66

HTS1  Post Sleep  HTS2  Post Sleep  HTS3  Post Sleep  HTS4  Post Sleep

Pre Sleep  Pre Sleep  Pre Sleep  Pre Sleep

Observed  Predicted

HTS – Hub Turn Sleep
Improved Rest Facilities

- 234 sleep rooms in Memphis (added 129 rooms at $3.4M in 2013)
- Additional Sleep rooms in CDG, KIX
- Sleep room facilities also available in IND, AFW, OAK
- Wakeup Program for Hub Operations
- Outstation rest facilities (standardization in progress)
- Approximately 65% of hub departing trips (at night) can benefit from nap type mitigation (234 out of 350 pilots)
- Use superior hotel rooms, with monitoring of day sleep quality (monitored by committee made up of pilots and company)

Intermediate Stop
> 1.5 hours – 4 hours rest facility
> 1.5 hours – 5 hours (in sort) sleep room
> 4 hours (without sleep room) hotel room

Sleep Rooms

Refreshing Facilities

777 Sleep Quarters
Sample crew data for IND night hub turns
Crew wakes up the same time every day (irrespective of flight delays).
Total lost opportunity for this crew = 2 hours for the week
Automated Wakeup Call Program

- Company taking responsibility to wakeup crews during hub turn naps.
- Increase nap opportunity and reduce anxiety during hub turns.
- Currently implemented in MEM and IND hubs
- Approximately 5000 hours of additional sleep opportunity every month
- First of its kind fatigue mitigation program in any mode of operations.

The FRMS Wakeup call program increases recuperation time between flights whenever the opportunity arises without anxiety of reporting late for the next flight. This improves both safety and efficiency as well as pilot well-being in FedEx Express 24/7 flight operations. With the implementation of this unique program, FedEx has further expanded its role as a global leader in operational fatigue risk management.

Dr Hans Van Dongen,
Director, Research Professor, Sleep and Performance Research Center, Washington State University