

Identifying and Mitigating Fatigue as a Safety Risk

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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

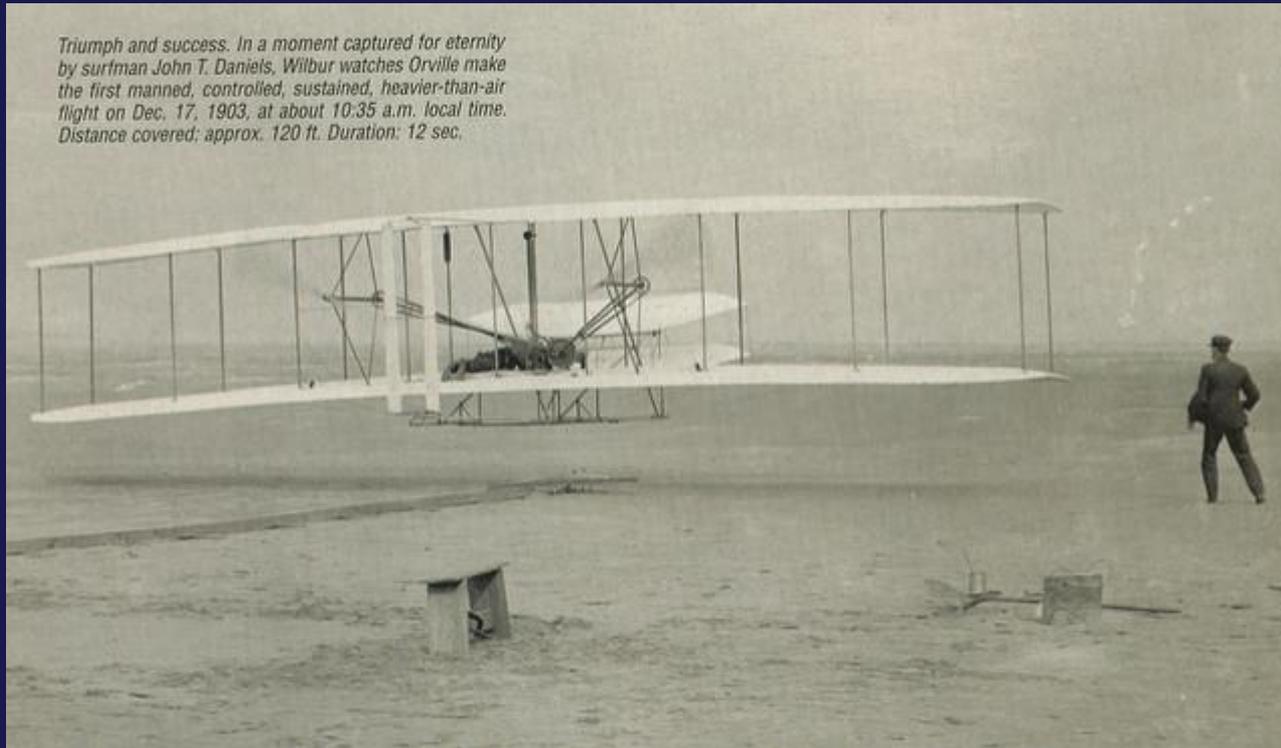
FAA, Flight Standards

Date: November 2, 2016



**Federal Aviation
Administration**

In the Beginning



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



Fatigue Risk Management Plan

14 CFR part 117

Fatigue Risk Management
System



Federal Aviation
Administration

14 CFR part 117

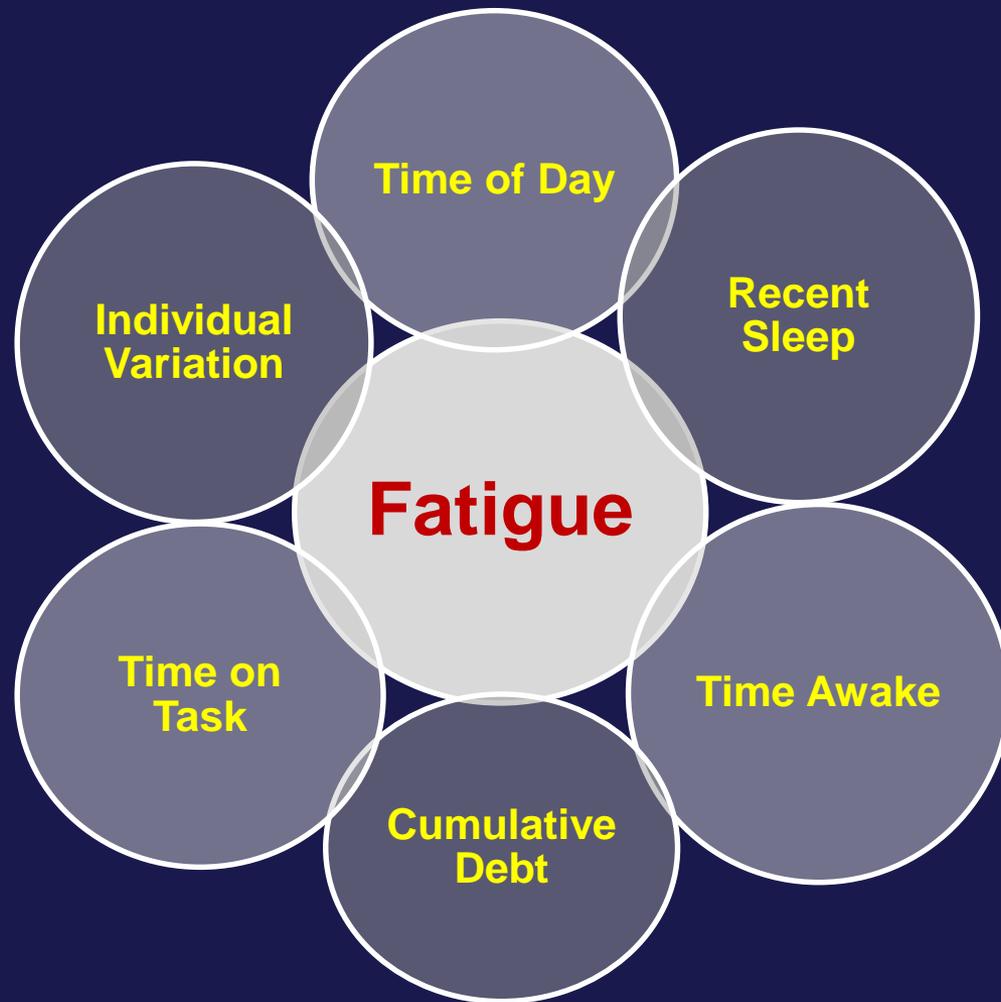


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Types of Fatigue



Fatigue Contributors



Fatigue Mitigations in Part 117

Transient Cumulative Circadian

Fitness for Duty
FEAT
FDP Limits
FDP Extensions
Split Duty

Fitness for Duty
FEAT
FDP Limits
FDP Extensions
CNO

Fitness for Duty
FEAT
FDP Limits

Rest
Emergency Ops

Rest
Emergency Ops



Fatigue Risk Management Plan

14 CFR part 117



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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

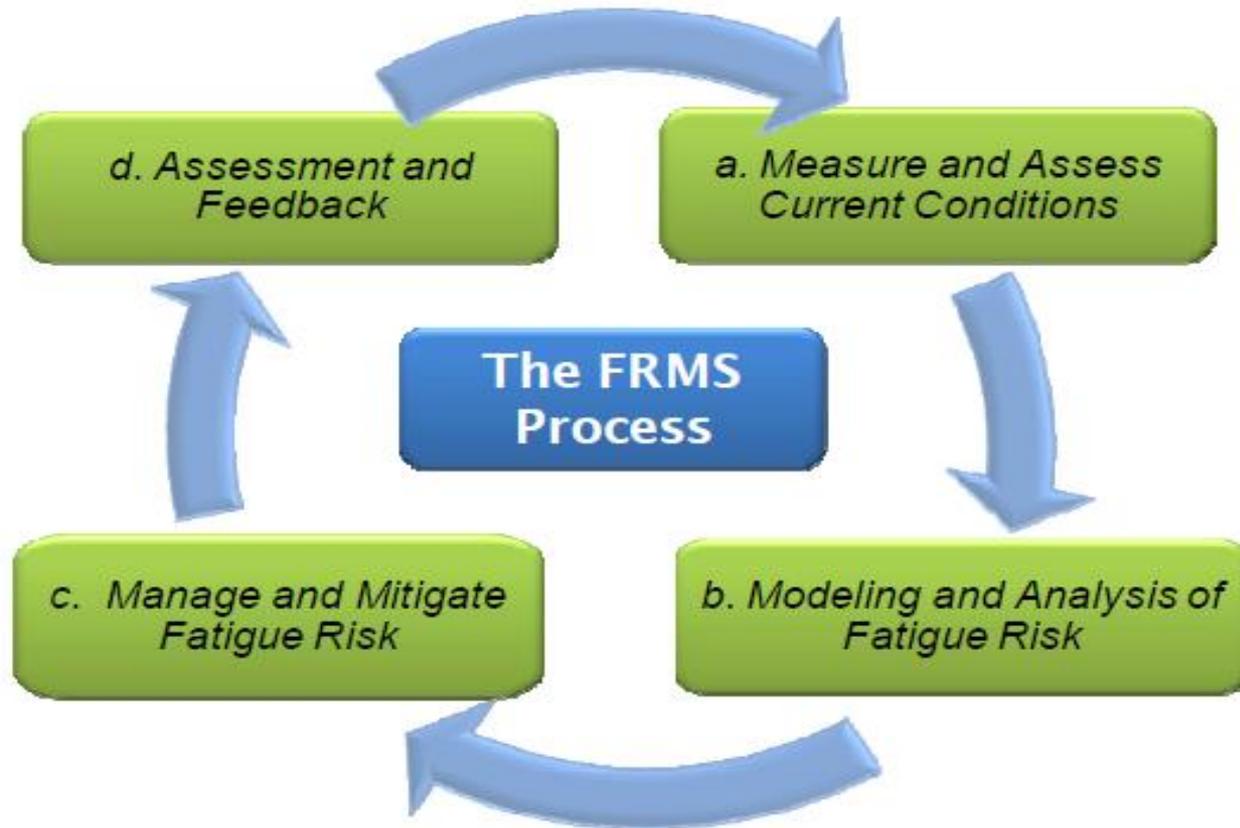
14 CFR part 117

Fatigue Risk Management
System



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FRMS Process



Thank You!

Questions?

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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

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

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

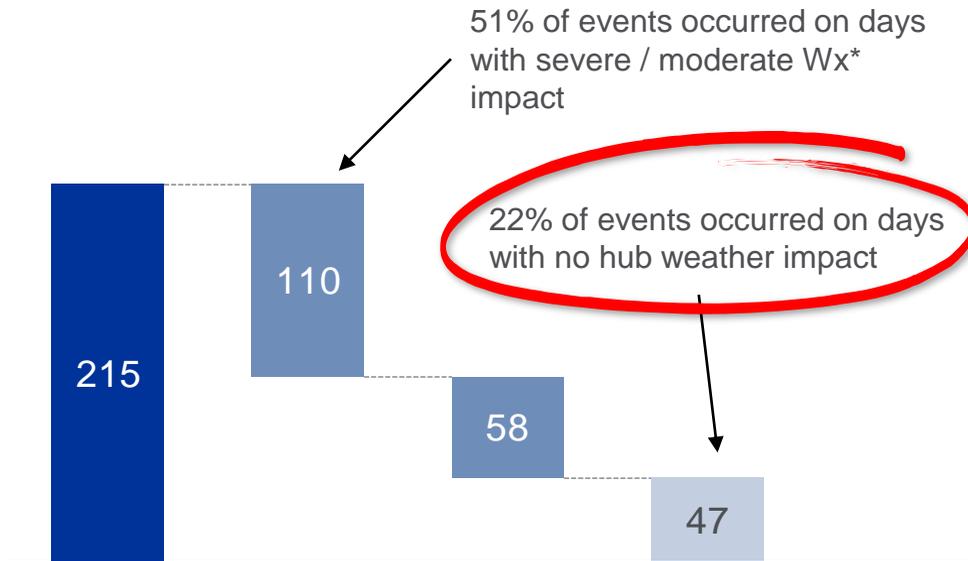
3) FAR 117 – in 33 months

- 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

Q3 2015

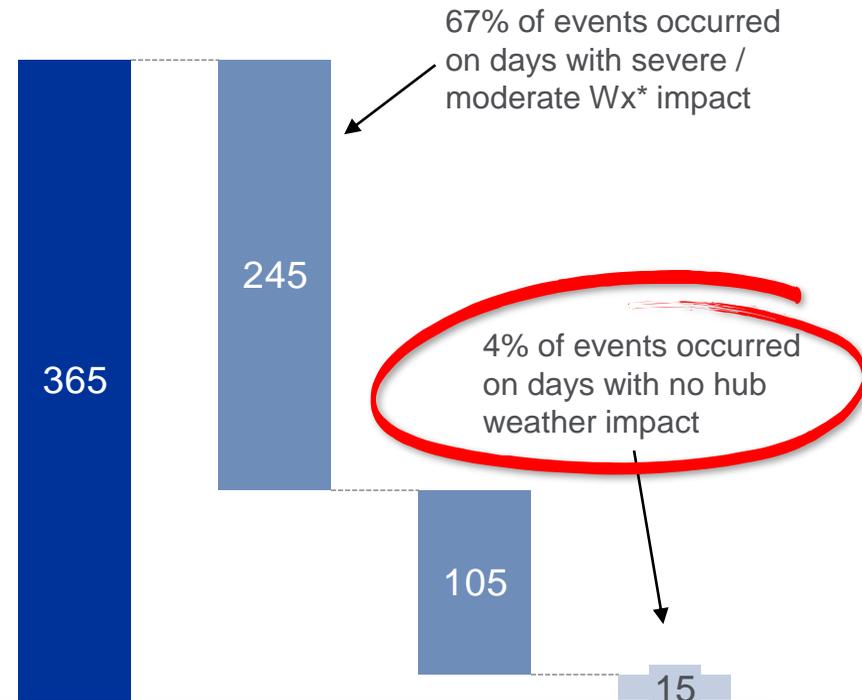
Count of FDP / FTE Events



Total **Days with Severe / Moderate Wx* Impact** **Wx Impact** **No Wx Impact**

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

Q2 2016



Total **Days with Severe / Moderate Wx* Impact** **Wx Impact** **No Wx Impact**

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

Drilldown of 117 Reportable Events – Q3 2016

Category	Q3 2016
FAA Reportable Events	365
Post Flight	(51)
Diversion	(46)
Non-Crew based	(78)
Taxi out exceedence	(40)
Remaining Events	150
Limited Rsv Coverage	(106)
Remaining events w/in United's Control	44

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

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

Action	2015	2016	% chg
Operated	933	1,512	62.1%
Re-crewed	624	791	26.8%
Cancelled	147	154	4.8%
Ttl Managed	1,704	2,457	44.2%

3Q 2016

3Q 2016

Let's Fly

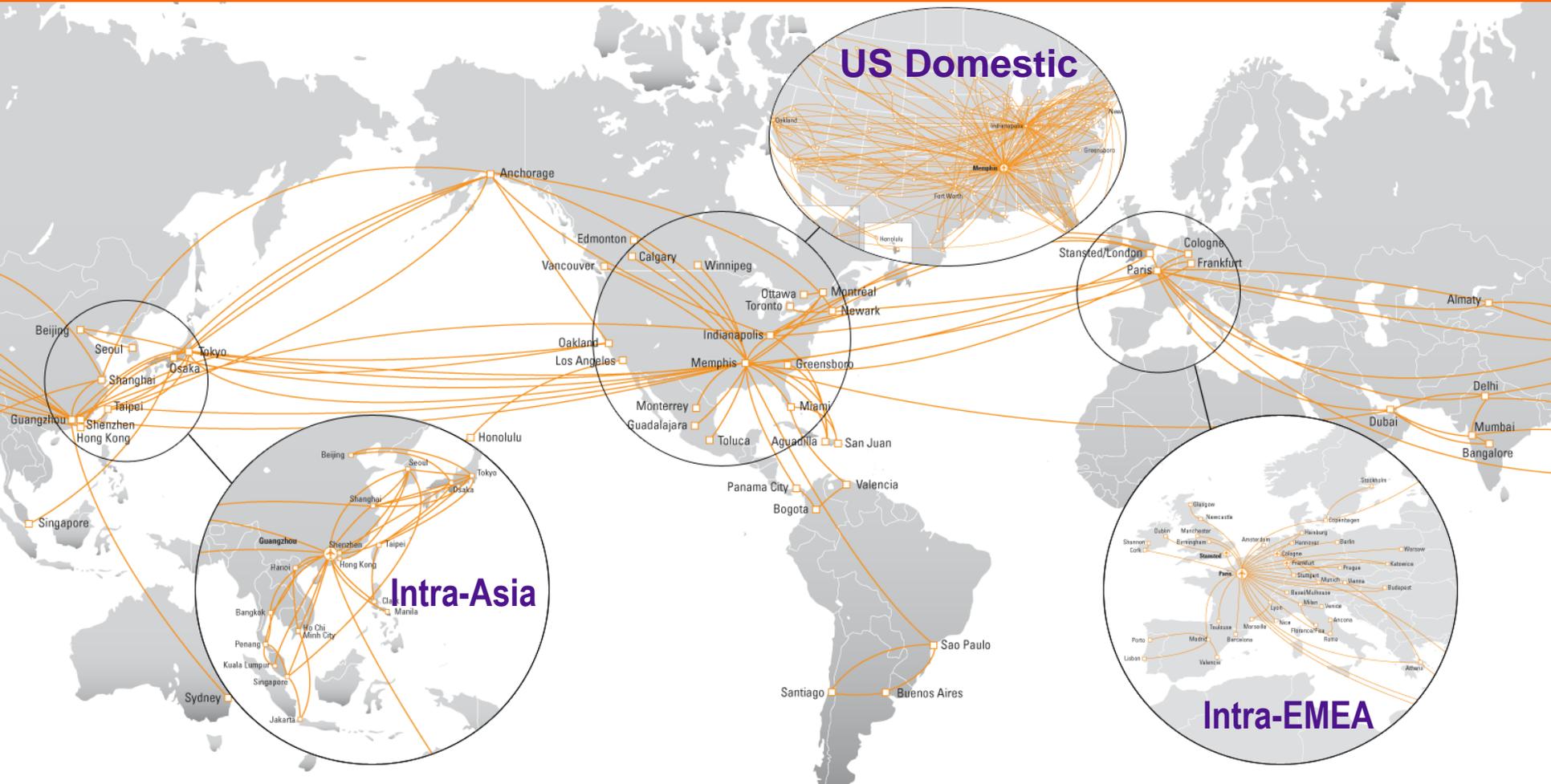


Identifying and Mitigating Fatigue



Nov 2016

Global Air Network



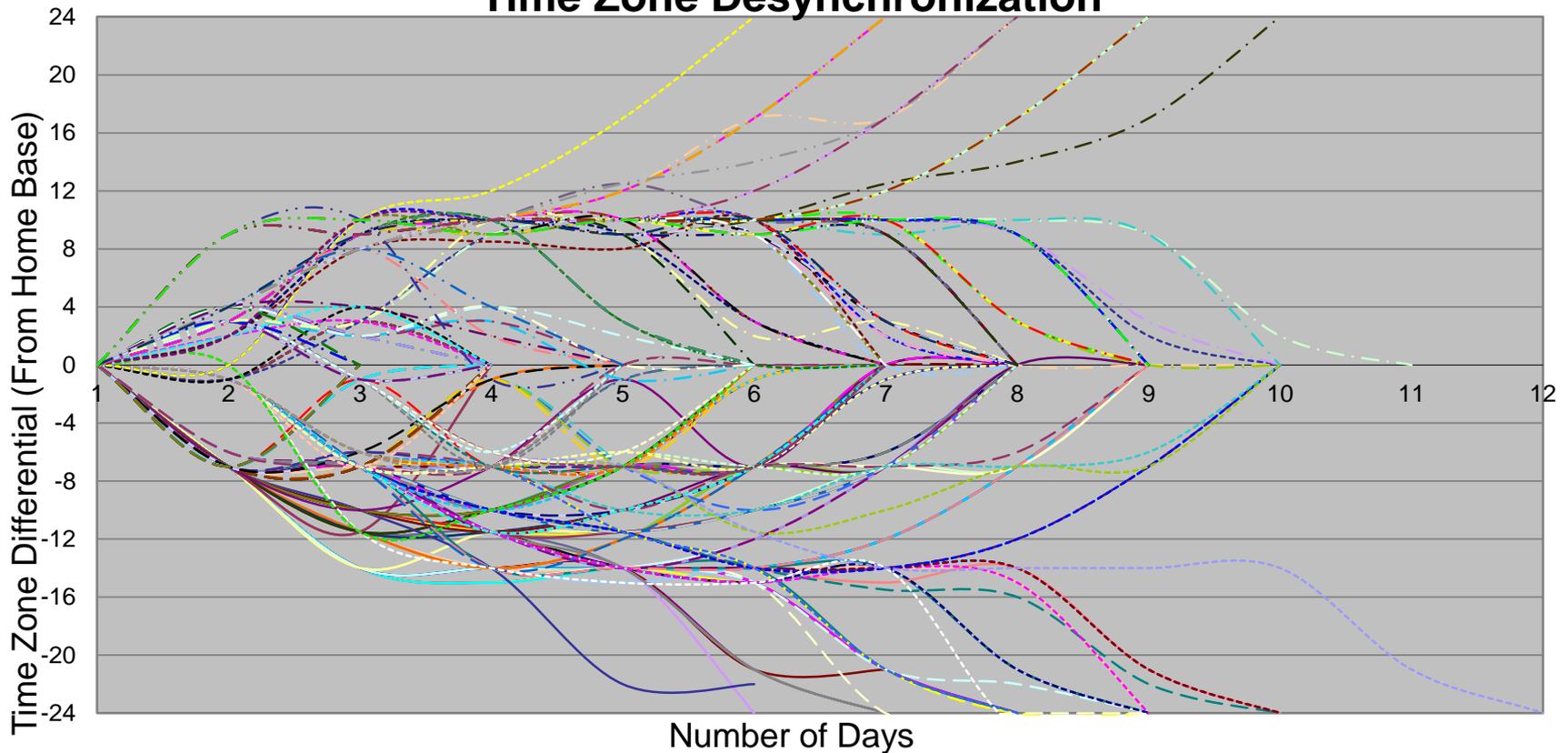
FedEx Express Flight Operations

By Numbers, Fleet and Operating Statistics



Trip Variety

International Schedules Time Zone Desynchronization



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

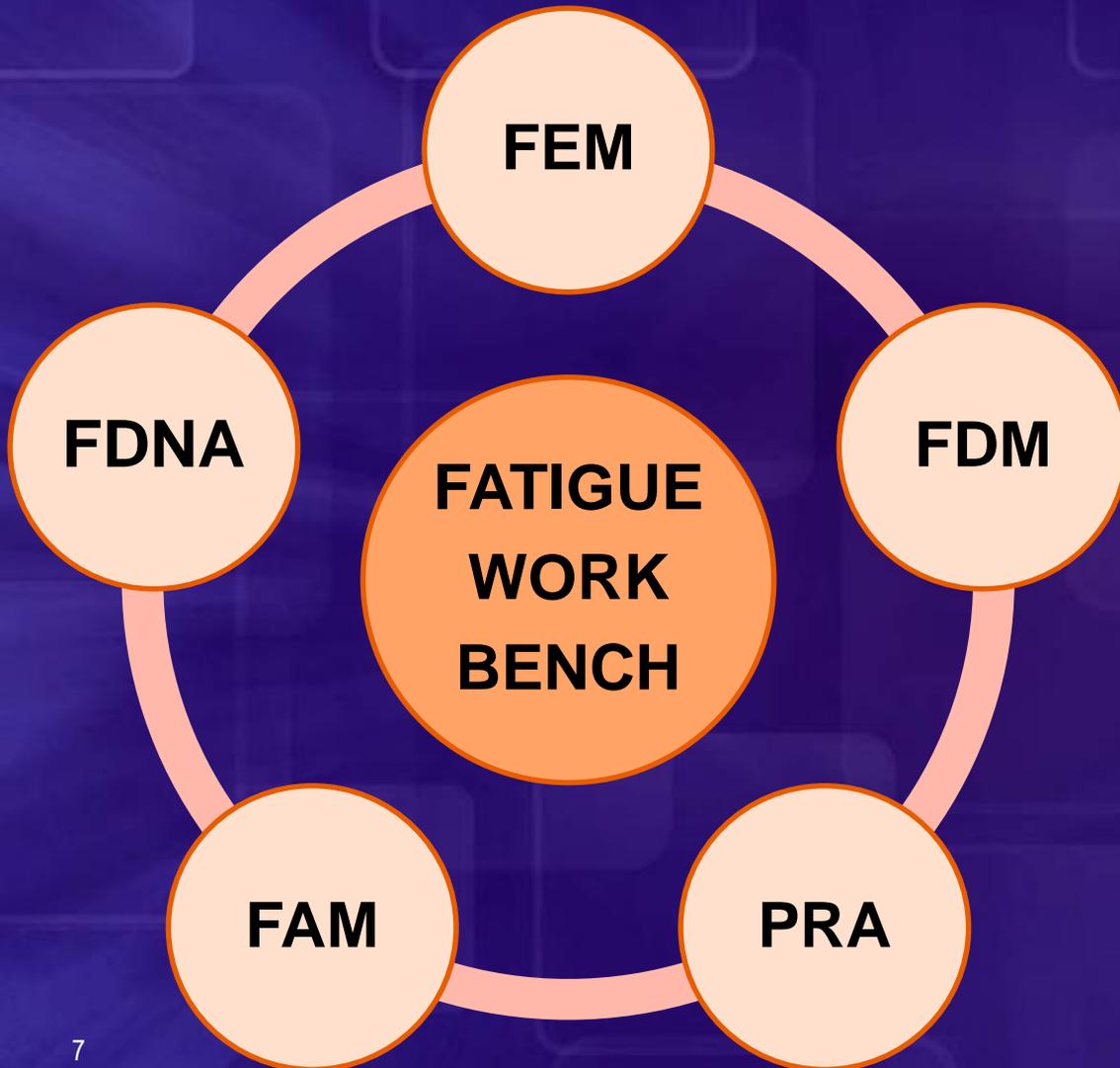
Fatigue Surveys

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



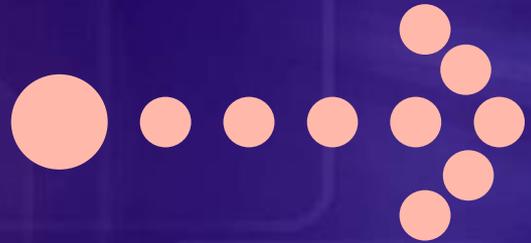
Fatigue Report Review



New Proactive Fatigue Review



Duty Extensions Review



Risk Assessment and Decision

Event Details

Event ID: 281 | Event Date: 09/11/2015 | Event Status: InReview

MEM | Flight Number: 0085 | Pilot ID: 437814 | Report ID: 8

ANC | 11 Sep 2015 10:42

Contribution Factors

- Disruption**
 - Weather
 - Maintenance
 - External (ATC, Ramp, Other)
 - Divert
- Duty**
 - Late Dept
 - Extended Duty
 - Extended Blk
 - Insufficient Rest
- Personal**
 - Rest (Home)
 - Health/Med
 - Commute
 - Other

Rest

- Layover
- Hub Facilities
- Other

Schedule

- Pairing Revision
- Reserve Assign
- Circadian Swap
- International
- Cumulative Fatigue

Selected Contributing Factors:

Maintenance, Extended Duty, Reserve Assign, Hub Facilities

Add Factors | Close

Fatigue Risk Assessment

Severity | Probability | Risk Assessment

SEVERITY (Most Credible Consequence)

Accident or Incident	Serious incident	Incident with error	Incident with less error
Empire State Building	Major injury	Minor injury	Minor injury with

Fatigue Risk Assessment

Severity | Probability | Risk Assessment

Risk Probability	Risk Severity				
	1	2	3	4	5
A	High	High	Serious	Moderate	Very Low
B	High	Serious	Moderate	Minor	Very Low
C	Serious	Moderate	Minor	Low	Very Low
D	Moderate	Minor	Low	Low	Very Low

Selected Risk Severity: Fatality or serious injury with total disability/loss of capacity
Selected Risk Probability: Effective. Consisting of several good controls

Description: 1212121

Update Assessment | Close

Event Analysis

Console | Modelling | Three Process Model

Events Reported

Report ID	Event Date	Base	Pilot ID	Seat	Pairing Nbr	Flight Nbr	Modified Date	Event Status
100	2014-10-09	EUR57	127231	CAP	12121	1212	2014-10-09	Reviewed
5319	2014-08-04	MEM55	445808	AUG	336	3612	2014-08-04	Created
123	2014-10-09	EUR57	12456	CAP	1234	1234	2014-10-09	Closed
123	2014-01-08	EUR57	123455	CAP	47	5203	2014-01-08	Reviewed

Performance Prediction | Sleep Prediction | Similar Fatigue Reports

Three Process Model

Alertness (red line), MSB (green bars), Sleep (blue bars)

Base	AC	R	L	S	W	187.5	187.2	P	143	Day	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
MEM	57	358	889V	0	0300	0715	0830	308	889V	0.0	0300	889	889V	1.0	0915	1.0	0415	0216	0105	088	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
MEM	57	358	889V	0	0215	0651	1600	889	308	889V	1.0	0315	0715	448	730V	1.0	0751	0.8	0438	0216	0120	016	2	2	2	2	2	2	2	2	2	2	2	2	2
MEM	57	358	889V	1	1818	0447	1127	07V	448	730V	1.0	1918	005	426	710V	1.0	0547	0.8	1029	0438	0335	080	2	3	3	3	3	3	3	3	3	3	3	3	3
MEM	57	358	889V	2	1920	2248	1341	805	426	710V	1.0	1928	MEM	308	889V	0.0	2248	1.0	0420	0320															

Close Event

Resolution: Select resolution | Pay removal: No

Close Event | Cancel

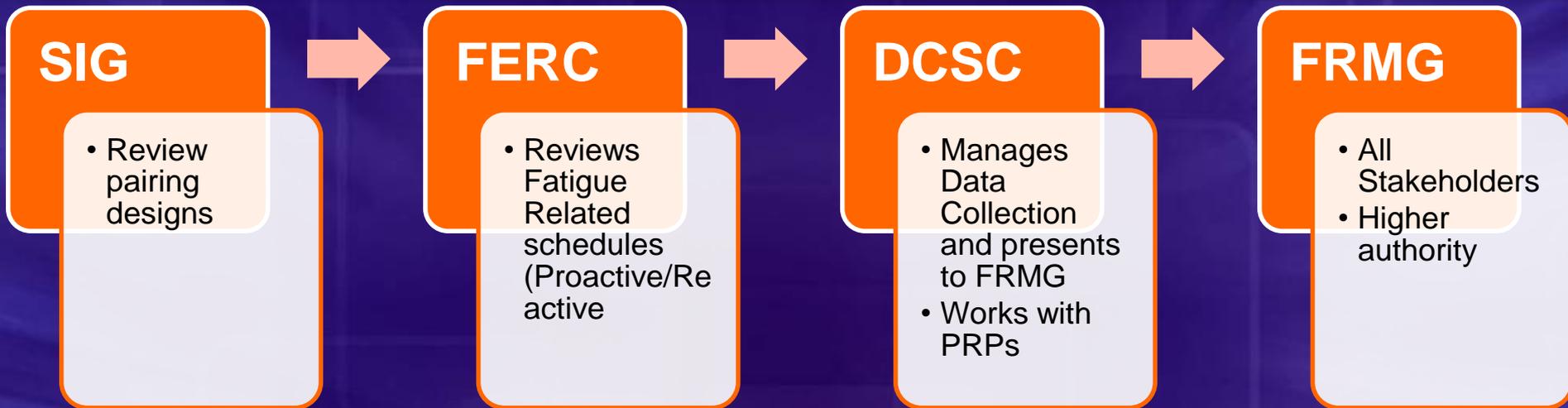
Schedule: Reserve Assign, Circadian Swap

Disruption: Weather, Maintenance

Schedules

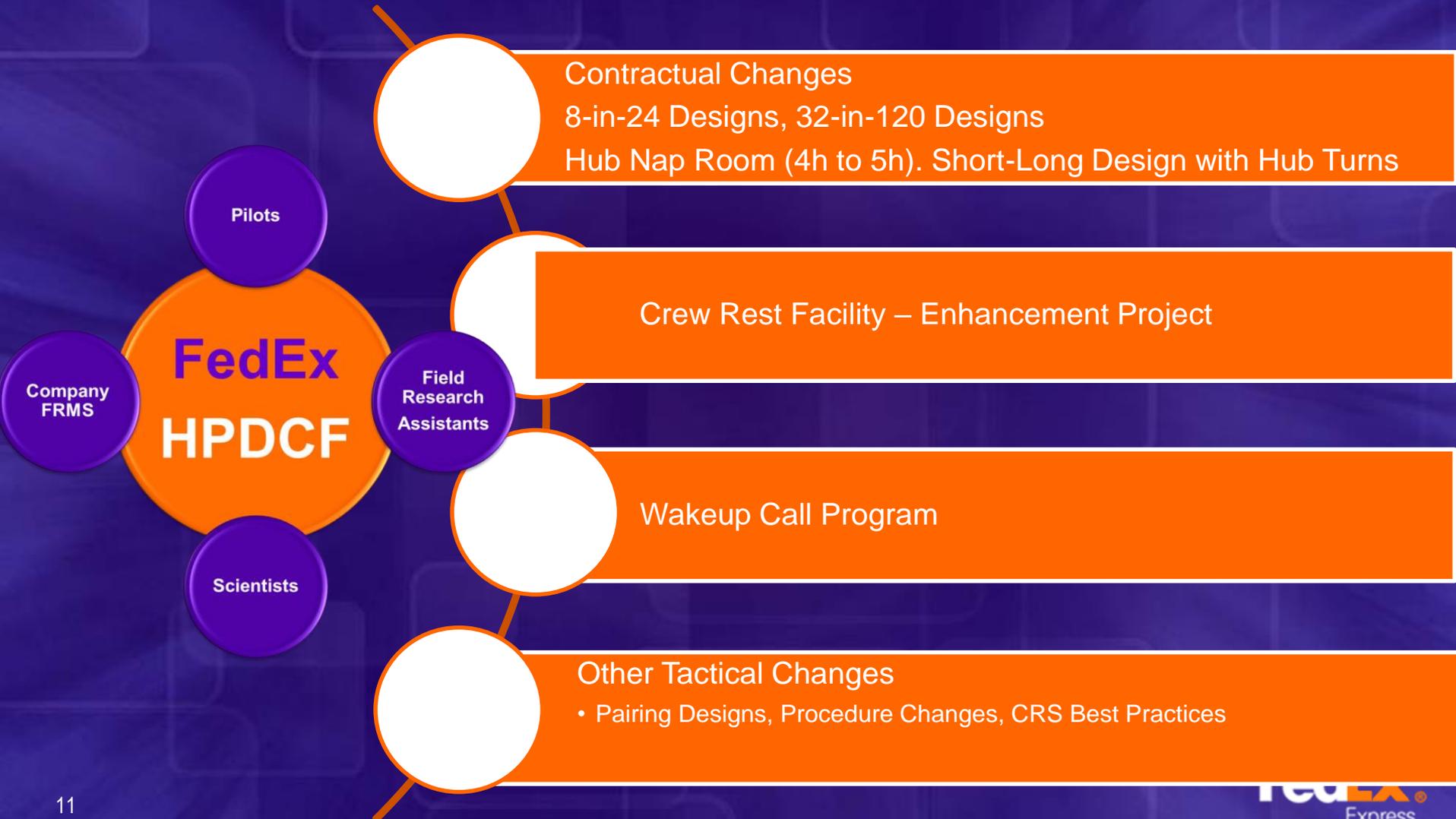
Events

Fatigue Working Groups



- **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



Improving Scheduling Rules

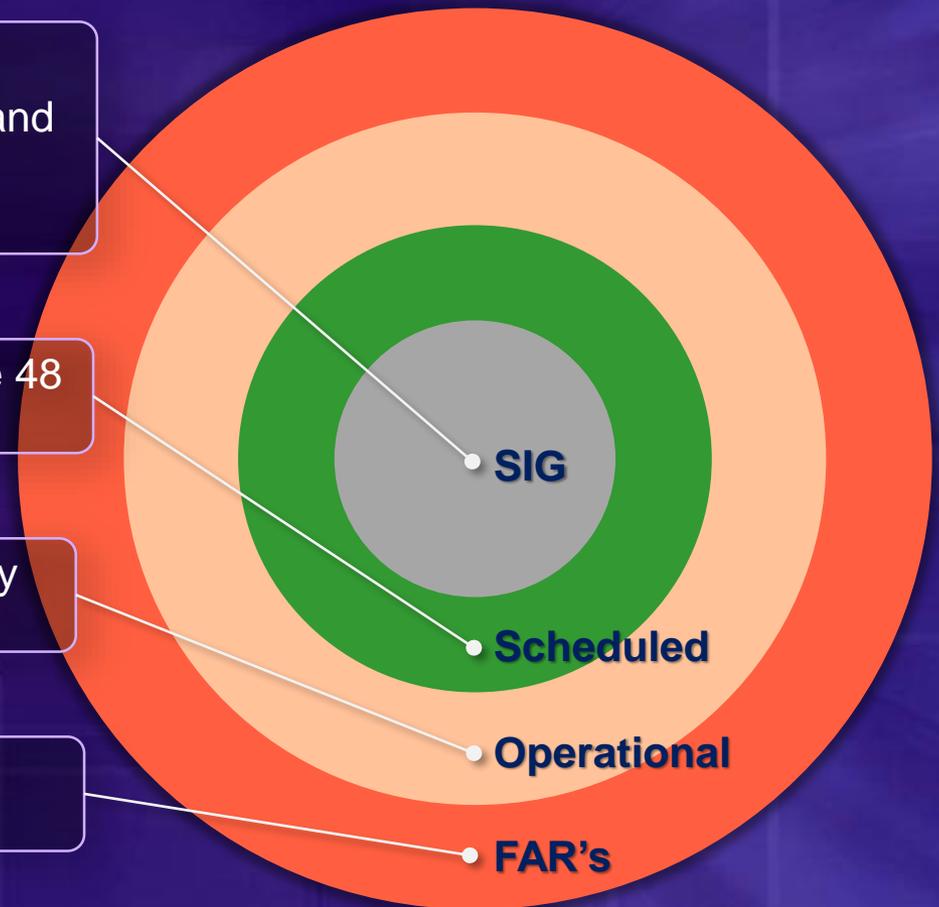
Schedule Improvement Group (SIG)

A cooperative effort between the company and ALPA to provide oversight in the monthly pairing and line construction process

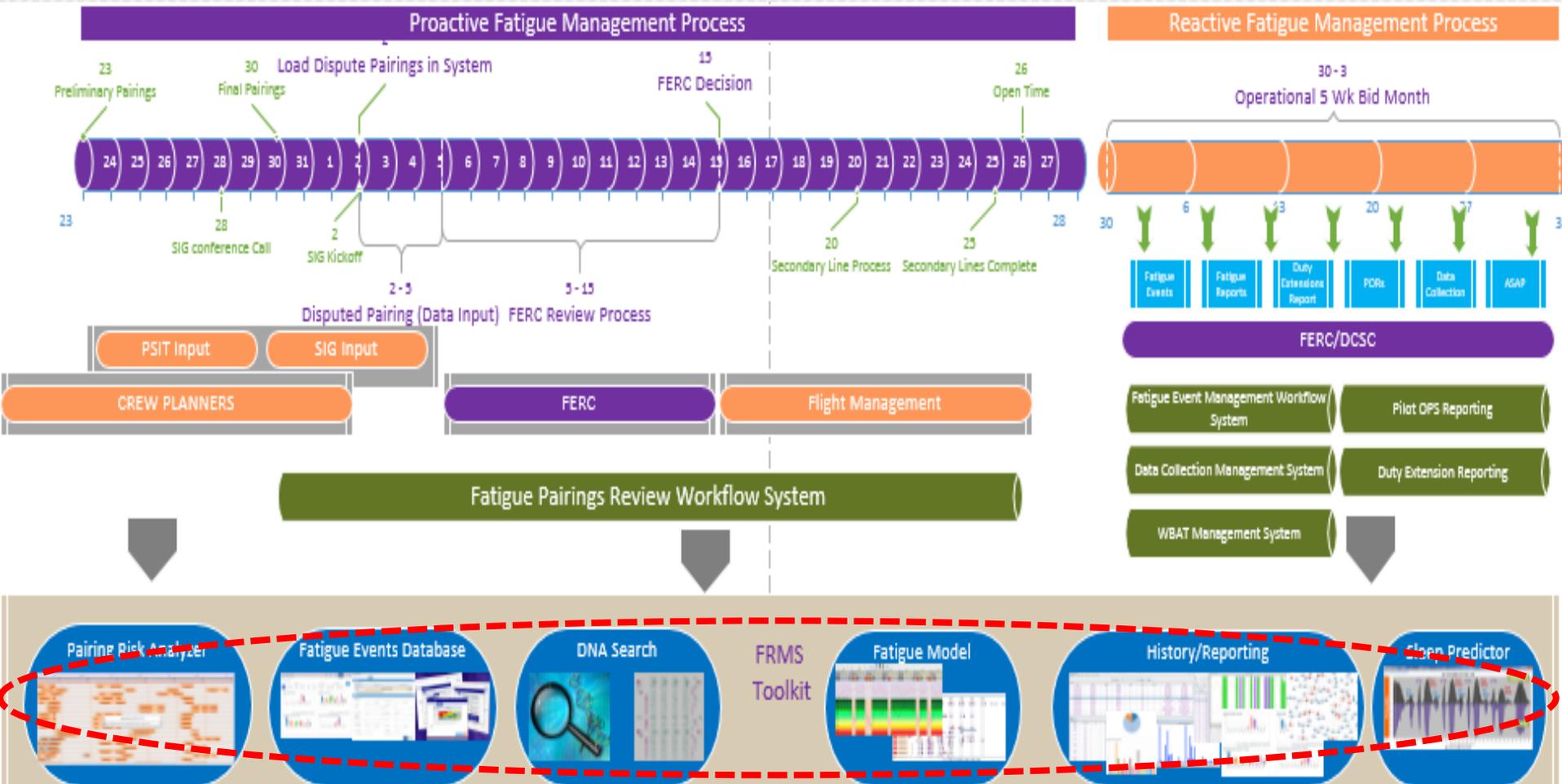
Scheduled Limits – Apply to trips Inside 48 hours Domestic and 96 hours International

Operational Limits – Apply once the duty begins

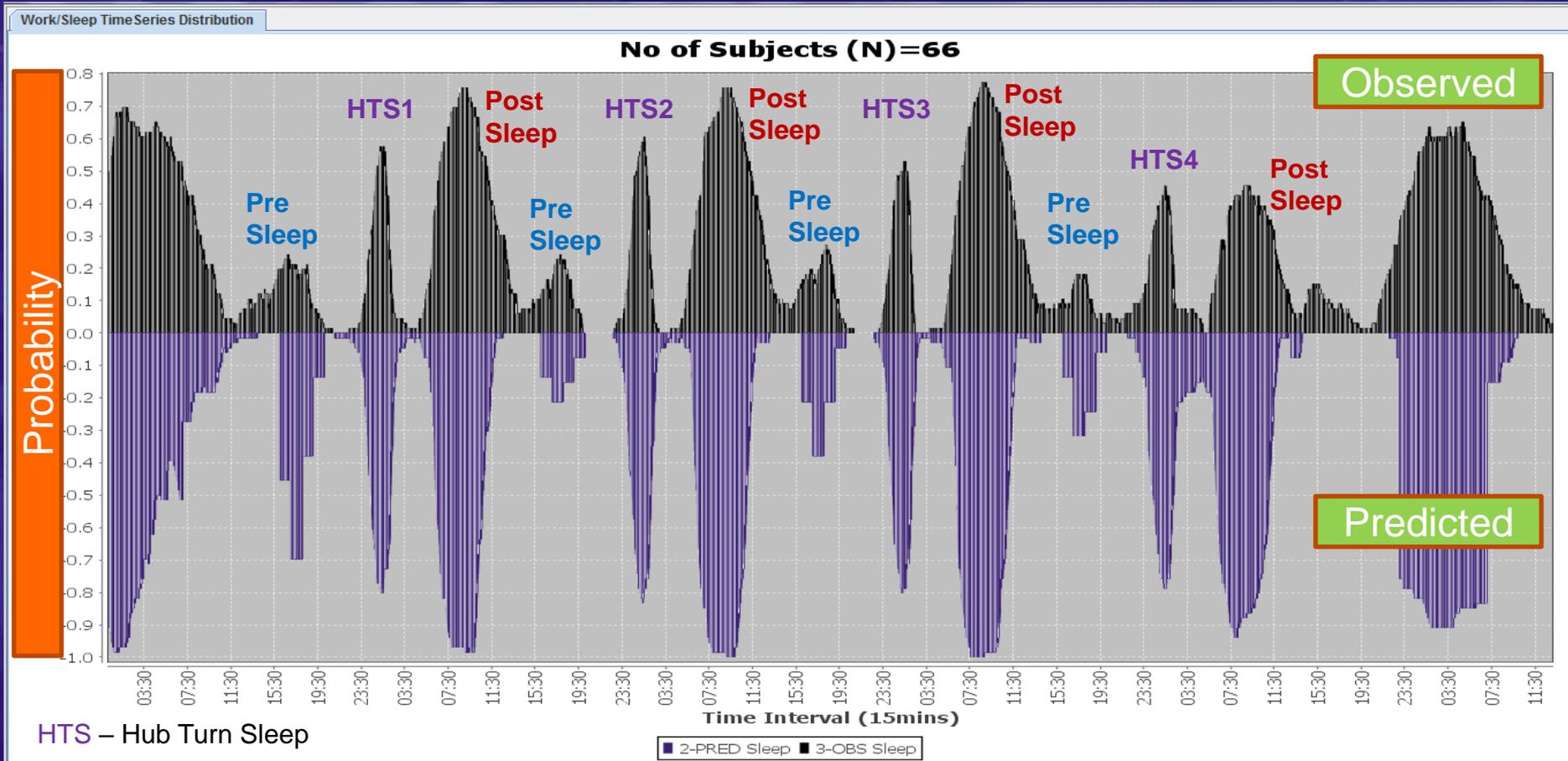
Federal Aviation Regulations – FARs



Continue to Evolve Automation



Continue to improve the Science Predicted vs Actual Sleep



Improved Rest Facilities

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



- 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)

Refreshing Facilities



777 Sleep Quarters



Wake Up Call Program Lost Opportunity

Prior to Wakeup call program

Objective human physiology data

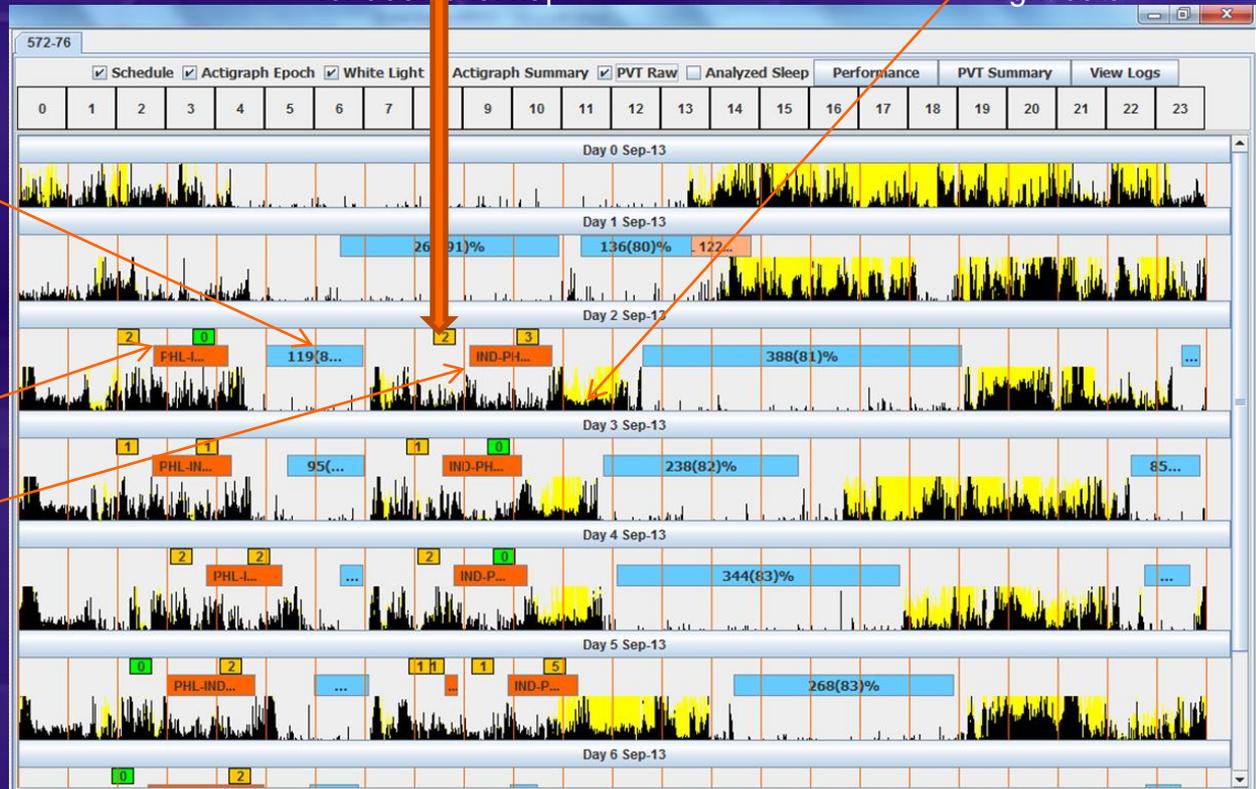
Flight delay and Possible opportunity for additional nap

Activity data and light data

Nap at the Hub

Flight into Hub

Flight out of Hub



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