# Air Crew Fatigue
## Risk Management

## A Validated Diagnostic Approach

Dr. Sunjoo K. Advani, PhD, IDT
Dr. Douglas Bradley, MD, UHN
Dr. Geoff Fernie, PhD, UHN

# Take Away

- Incident analysis indicates significance of human factors linked to alertness and fatigue
- Air crews are subject to difficult duty cycles and long periods of sitting that have cumulative negative health effects
- Sleep apnea diagnosis may provide critical information on risk:
  - Falling asleep, inappropriate response to unexpected events, long-term health consequences
- Correct diagnosis is needed, and available
- Starting a study to investigate prevalence of sleep deprivation issues in flight crew population

# Fatigue in Aviation

- Pilot duty cycles require variable shifts, cause single-duty fatigue, and prone to irregular sleep patterns
- Impacts alertness, performance, response to unexpected events
- One treatable condition that could contribute to pilot fatigue is obstructive sleep apnea (OSA)

# Obstructive Sleep Apnea (OSA)

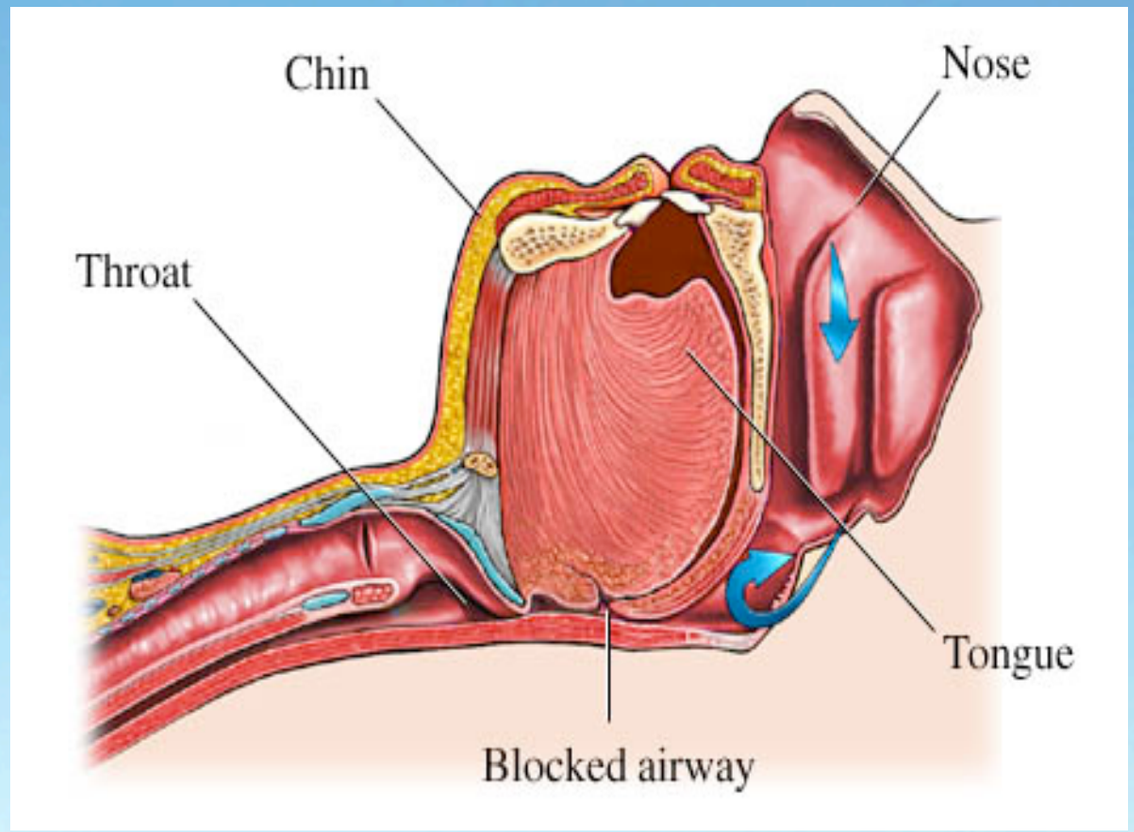
- One treatable condition that could contribute to pilot fatigue is obstructive sleep apnea (OSA)

Apnea – Complete

Hypopnea - Partial

| | |
|---|---|
| Central (CSA) | 5% |
| Obstructive (OSA) | 90% |
| Mixed | 5% |

Duration – 10 to 120 secs




Frequency – 5 to 120/h sleep (apnea-hypopnea index – AHI)

# The Problem

OSA affects 6 to 8% of the adult population

Largely (~85%) undiagnosed and untreated because of lack of access and high cost of gold standard diagnosis by polysomnography (PSG)

Short Term Effects

- Drop in Blood Oxygen Levels (Hypoxia)
- Frequent Awakenings/Sleep Disruption
- Poor Sleep Quality
- Sympathetic Activation (Surge of Adrenalin)

# The Problem

**Long Term Effects**

- Excessive Daytime Sleepiness
  - 3-4 times risk of auto accidents ($15.9 billion and 1,400 lives in USA)
- Increased risk of cardiovascular diseases:
  - 4 times risk of hypertension
  - 3 times risk of heart failure
  - 3-4 times risk for stroke
- Cancer links presumed; being validated

Sleep labs - Expensive and in short supply

**Need - an accessible, affordable, reliable way to reach a broader group**

# Fatigue Measurement

- FAA attributes some incidents to OSA
- NTSB: in a set of 34 accidents, 32 of which were fatal, OSA was diagnosed; 294 incidents involving some type of sleep disorder
- 4,917 FAA pilots being treated for OSA (special issuance medical certificate).
- Of these, only 347 have a BMI of 40 or greater

# Diagnosis: The Gold Standard -Polysomnography

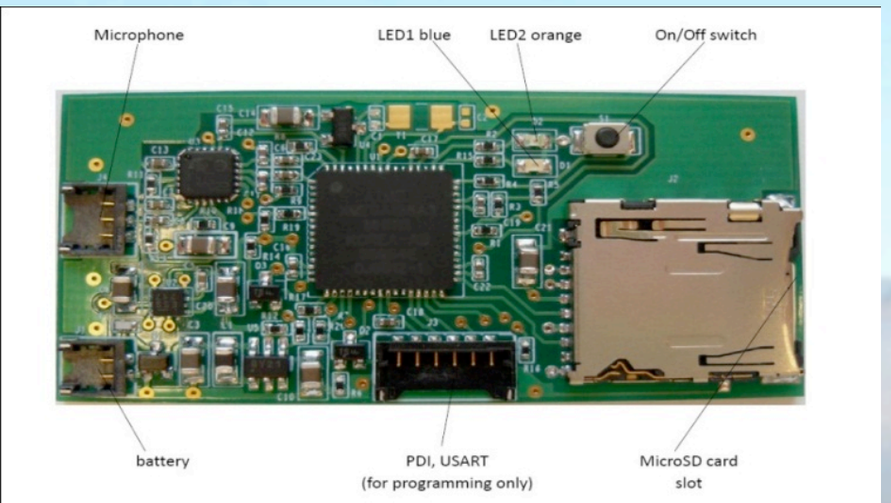
- $1500 to $3000 in USA
- Limited availability
- Complex
- Manual analysis
- Overnight in a sleep lab

# Solution

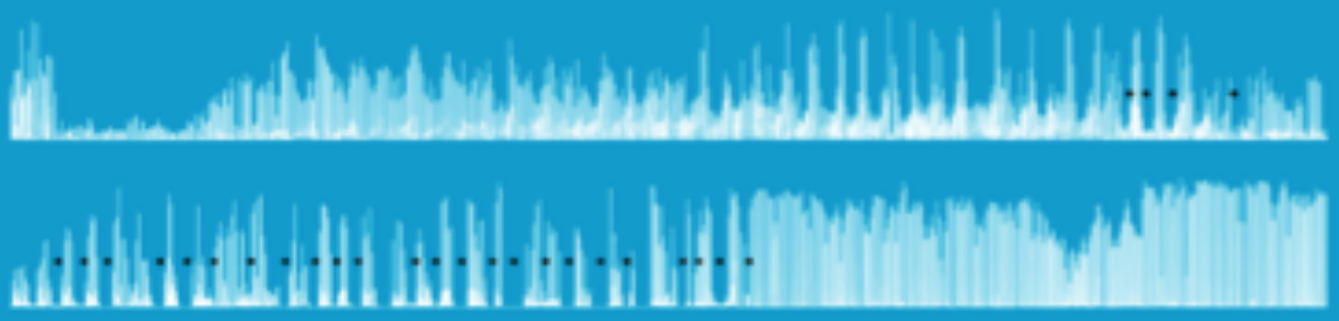
## A Better Way of Diagnosing OSA

Monitors and analyzes breathing sounds during sleep at home or “on the road”:

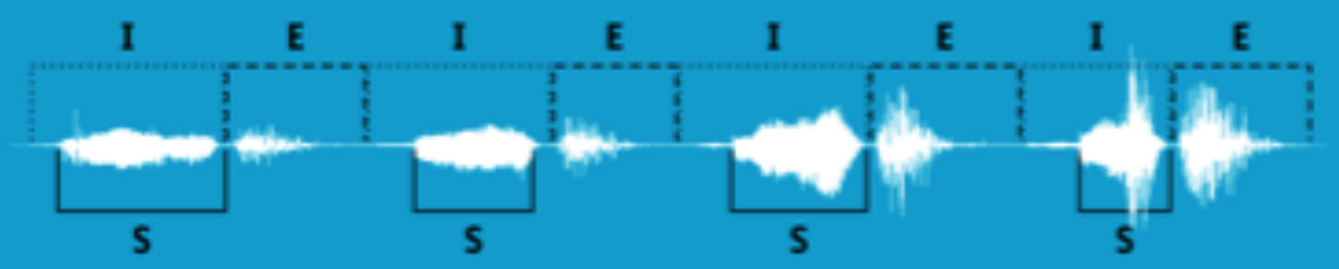
- Simple
- Inexpensive
- Portable (home use)
- No wait-time
- Battery powered
- Wireless
- Single use




# New standard for apnea testing



Breath sounds and airflow with detection of apneas and hypopneas




Inspiration (I), expiration (E) and snoring (S)


Sleep time


Head position


Apnea-Hypopnea Index (AHI)

# TREATMENT OF OSA

- Avoidance of alcohol and sedatives
- Avoidance of supine position if apneas are supine- related
- Avoidance of weight gain
- Weight loss in the obese
  - diet and exercise
  - bariatric surgery
- CPAP

# Conclusions

- Studies needed to determine how common OSA is in airline pilots and link with fatigue and fatigue-related mishaps
- Such trials should involve inexpensive and portable, but accurate means of diagnosing OSA so that pilots undergo testing with minimal inconvenience
- Solution shown may provide a convenient means of diagnosing OSA at home or “on the road” at minimal inconvenience to pilots and at minimal cost to airline and insurance companies