



NTSB National Transportation Safety Board

Managing Fatigue in 24/7 Ops: Lessons Learned from Transportation

Honorable Mark R. Rosekind, Ph.D.
Board Member

Transportation Disaster Response Course
NTSB Training Center
November 17, 2011



Home > Transportation Safety > Most Wanted List

SHARE [Facebook] [Twitter] [Email]

MOST WANTED LIST

A program to increase the public's awareness of, and support for, action to adopt safety steps that can help prevent accidents and save lives. The following are ten of the current issues.



Addressing Human Fatigue



General Aviation Safety



Safety Management Systems



Runway Safety



Bus Occupant Safety



Pilot & Air Traffic Controller Professionalism



Recorders



Teen Driver Safety



Addressing Alcohol-Impaired Driving



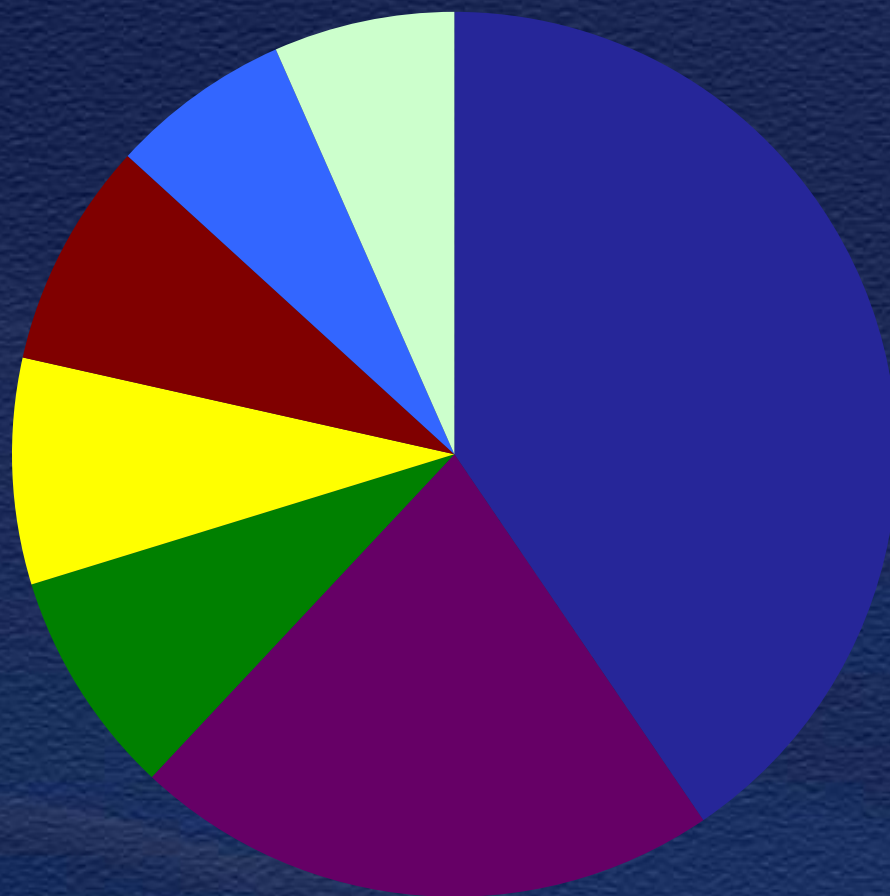
Motorcycle Safety



NTSB Fatigue Recommendations

- MOST WANTED since 1990
- ~200 fatigue recommendations

Complex Issue: Requires Multiple Solutions



- Scheduling Policies and Practices
- Education
- Organizational Strategies
- Raising Awareness
- Healthy Sleep
- Vehicle and Environmental Strategies
- Research and Evaluation

Education/Strategies

- Develop a fatigue education and countermeasures training program
- Educate operators and schedulers
- Include information on use of strategies: naps, caffeine, etc.
- Review and update materials

Challenges of a 24/7 Society



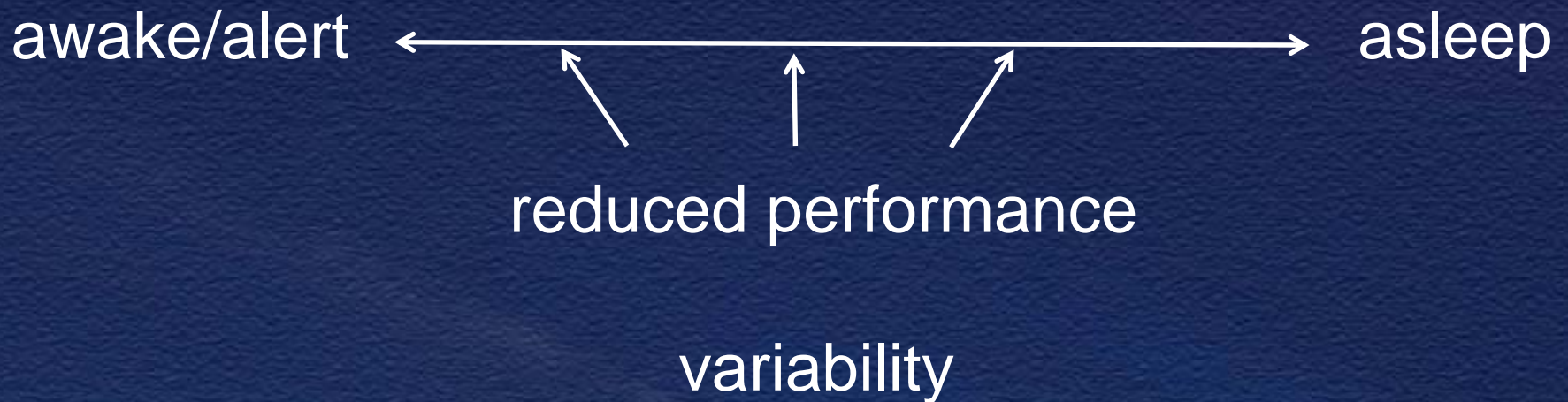
NTSB



Fatigue Risks

Fatigue can degrade
every aspect of
human capability.

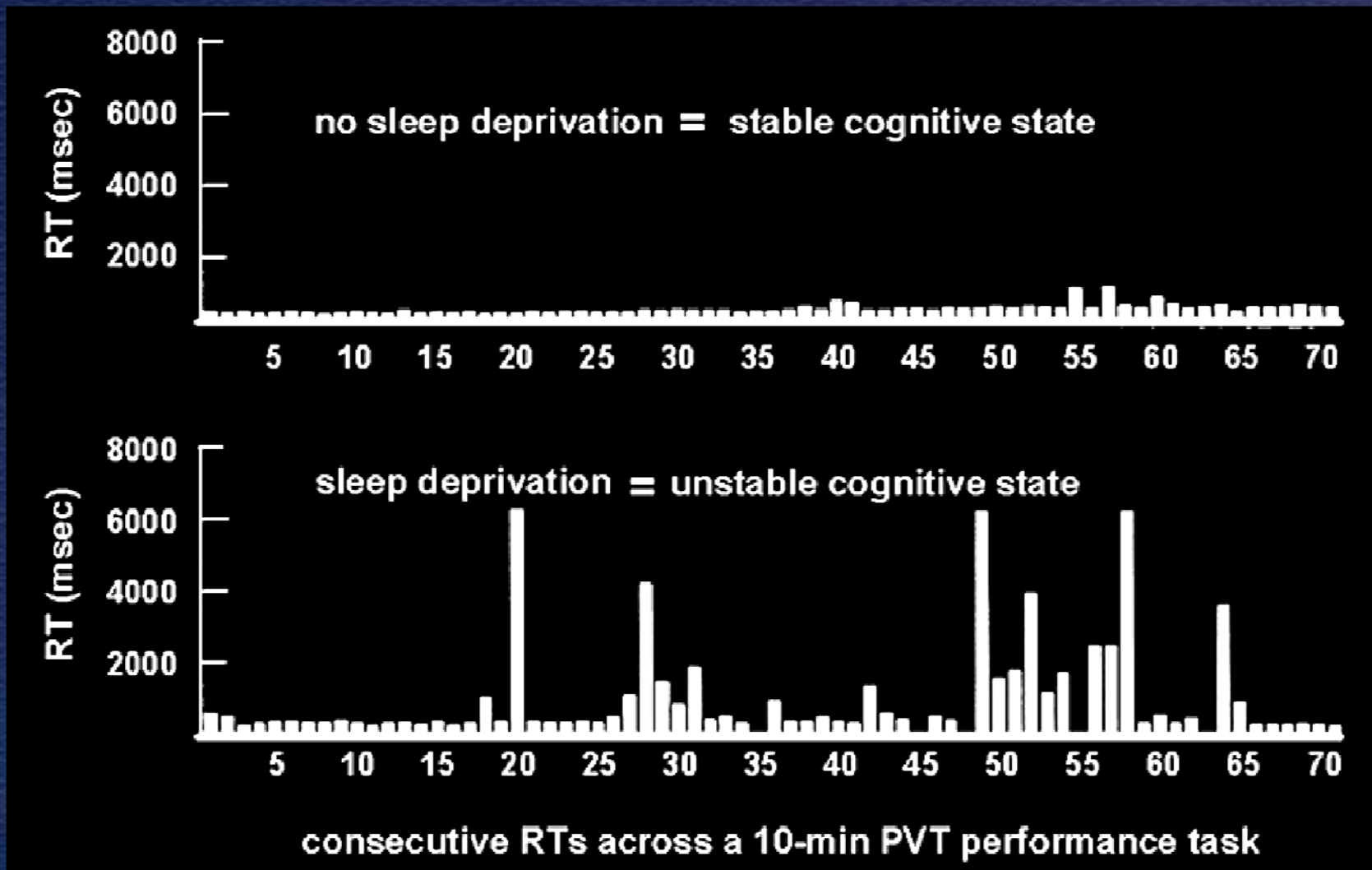
Fatigue Risks



Fatigue Risks

- reduced (20 – 50%+):
 - reaction time
 - memory
 - communication
 - situational awareness
 - judgment
 - attention
 - mood
 - more . . .
- increased:
 - irritability
 - apathy
 - attentional lapses
 - microsleeps

Fatigue and Reaction Times



Doran SM, Van Dongen HP, Dinges DF. Sustained attention performance during sleep deprivation: evidence of state instability. *Archives of Italian Biology: Neuroscience* 2001;139:253-267.



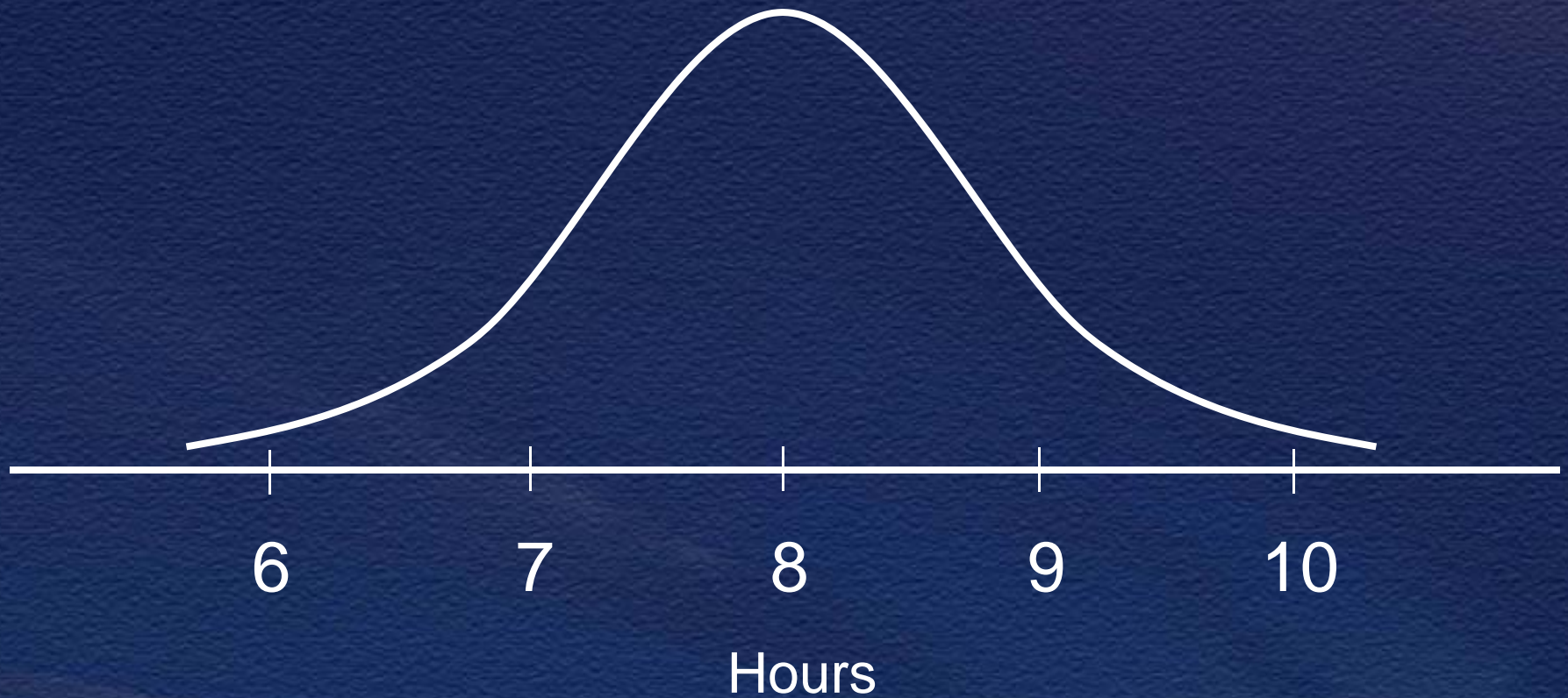
Fatigue Factors

- sleep
- circadian clock
- hours awake
- sleep disorders

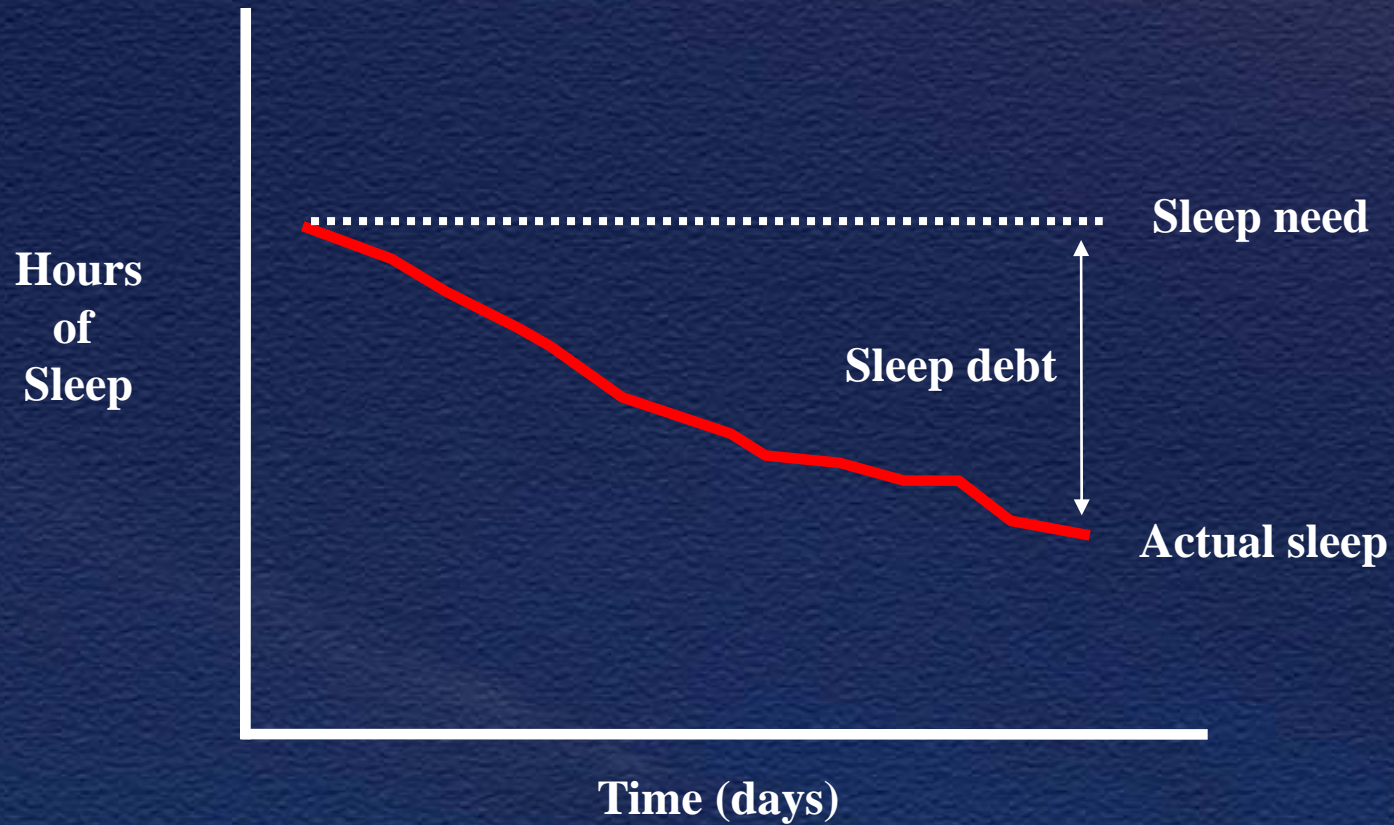
Fatigue Factors

- sleep
 - acute sleep loss
 - cumulative sleep debt
- circadian clock
- hours awake
- sleep disorders

Sleep Requirement



Cumulative Sleep Debt



Sleep Need – Actual Sleep = Sleep Debt

Sleep debt grows cumulatively over time

Fatigue Factors

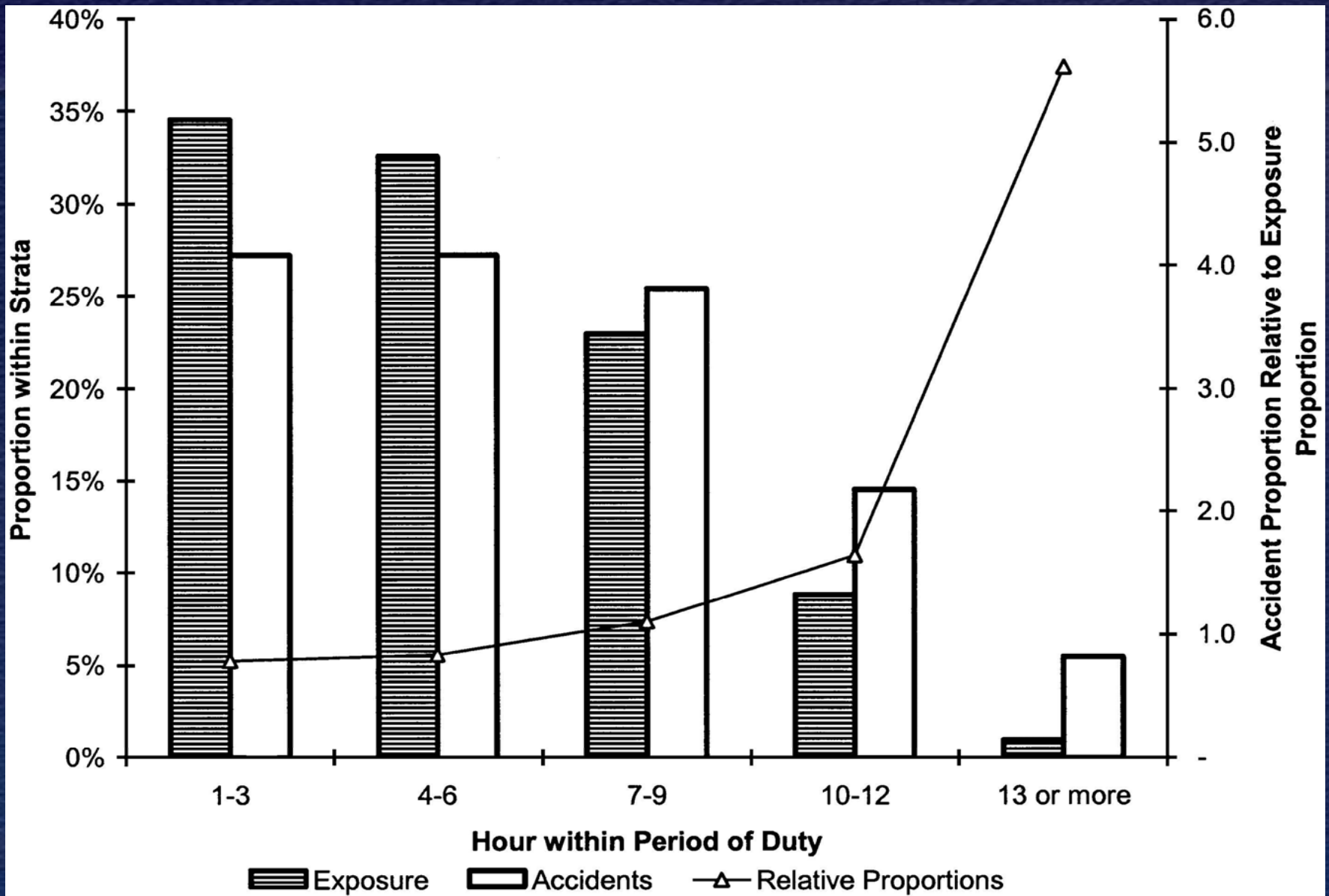
- sleep
- circadian clock
 - 'sleepy' windows
 - 'alert' windows
 - irregular schedule
 - time zones
- hours awake
- sleep disorders

“Adapting” to Shift Work

- In most instances, complete circadian adaptation to night shift work never occurs
 - early morning light prevents adaptation
 - reversion to day-active schedule on days off

Fatigue Factors

- sleep
- circadian clock
- hours awake
 - > 12 hrs
 - > 16 hrs
 - 24 hrs
- sleep disorders



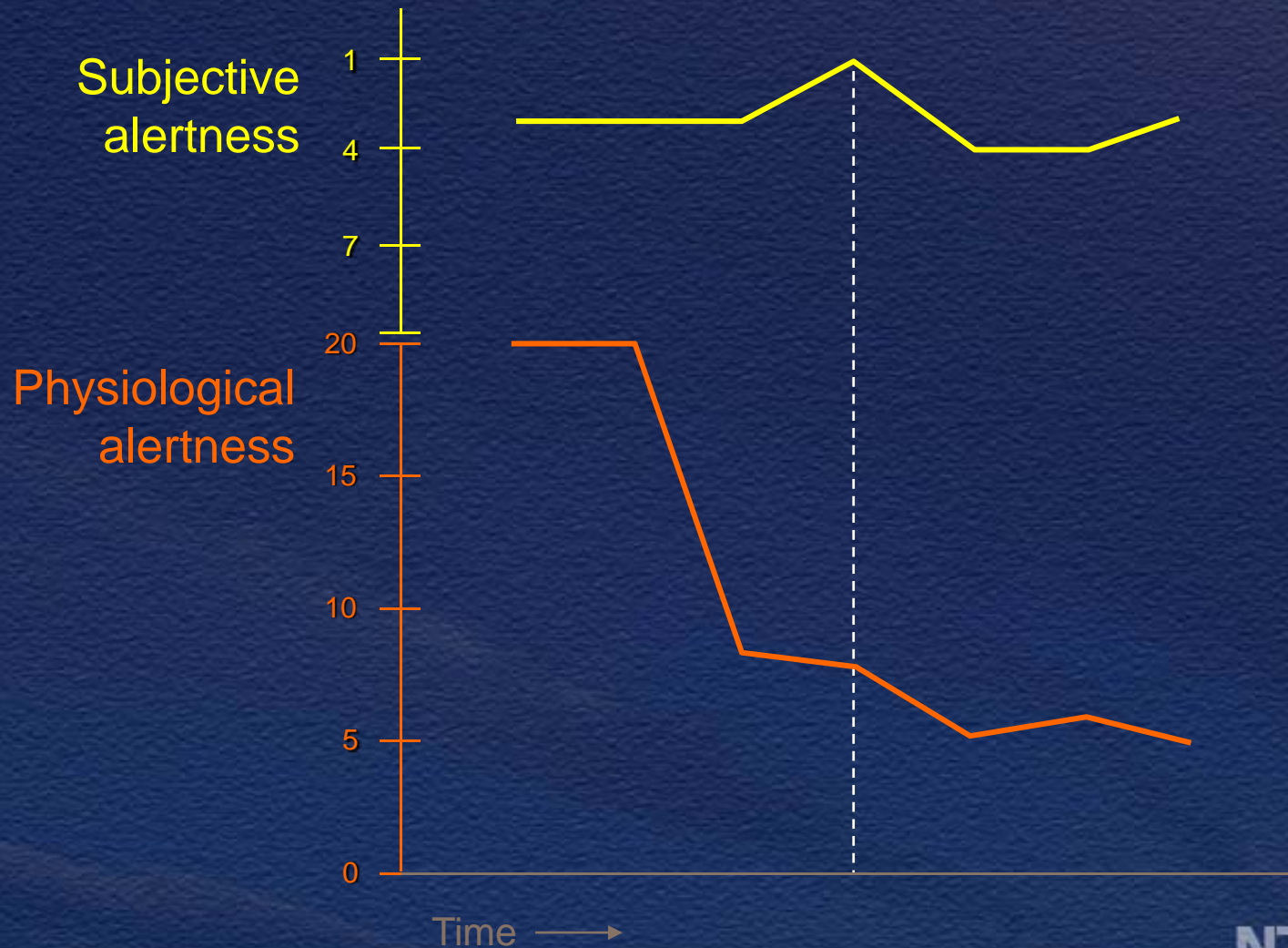
Fatigue Factors

- sleep
- circadian clock
- hours awake
- sleep disorders
 - ~ 90 sleep disorders
 - sleep apnea

Sleep Apnea is a Safety Risk

- > 6 times increased risk for crash
- > 7 times increased risk for multiple crashes
- SA performance = .06 - .08 BAC

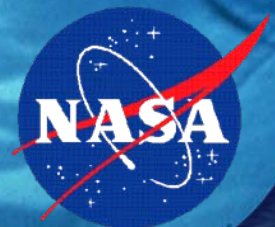
Alertness Reports Often Inaccurate



Adapted from Sasaki et al., 1986

NTSB





NTSB





NTSB