

AWO Joint Safety Committee Meeting
Briefing on
Crew Endurance Management Systems
Ongoing Research Conducted by
Northwestern University

January 28, 2010

Introduction

Many aspects of towing vessel operations are favorable from a fatigue/endurance perspective

- Predictable work schedules
- Crew often rotates together
- Often assigned to the same vessel
- Repetitive/non-variable watchstanding routine facilitates circadian adaptation
- Comfortable rest environment

CEMS Implementation

CEMS' most challenging aspect...

- Desired sleep goal has been the most problematic, impacting CEMS implementation
- Crew members should have 7 – 8 hours of uninterrupted sleep per 24-hr period.
- Implication:
 - Move from 6:6:6:6 square watch to a 7:7:5:5 or 8:8:4:4

CEMS in Practice

The Problem:

- No 2- or 3-watch schedule realistically allows crew to achieve goal
- Watchstanding changes impact front watch and back watch differently
- Crew members working square watch have resisted moving to rectangular watch

Criticism of CEMS notwithstanding... There continues to be a sense of urgency

Issues

- Voluntary program
- Not all aspects have been implemented
 - Half of vessels in demonstration project have not changed existing square watch schedule
 - Square watch does not allow enough uninterrupted sleep to maintain alertness level

Introduction

Engagement with Northwestern

Several towing companies involved with Northwestern Transportation Center engaged Northwestern's Center for Sleep and Circadian Biology to assess watch change best practices and strategies to improve sleep behavior

Existing Space Research

- Sleep duration is largely unaffected by whether the sleep was placed at night or split between nighttime anchor sleep periods and daytime naps
- Flexibility in sleep timing, including the use of split-sleep schedules, is possible without sacrificing sleep quality or quantity.

- Assessments of sleepiness was found to be primarily a function of total time in bed per 24 hrs regardless of how sleep was divided among nighttime anchor sleep and daytime nap periods.
- Reductions in total daily sleep result in accumulation of impairment regardless of whether sleep is scheduled as a nighttime or split into a nighttime anchor sleep period and an afternoon nap.
- Split sleep schedules are feasible and can be used to enhance the flexibility of sleep/work schedules

Northwestern Project Review

- **Phase I** – Research Review & Proposal 6/08-7/08
 - Review of literature
 - Applicable research analysis
 - Submitted research proposal (for Phase II)
- **Phase II** – Onboard research 11/08-4/09
 - 4 x 10-day vessel trips
 - 1 x 28-day vessel trip
- **Phase III** – November 2009 – 2011
 - Develop, implement and test napping/anchor sleep strategies to increase total sleep time

Onboard Research Summary

- Obtained good data
- Crews interested and cooperative
- Fitness and wellness issues
 - BMI ranged from 26.6 - 47.2
 - Sleep disorders such as sleep apnea and insomnia
 - Age 20-65 years
 - Front watch
 - Back watch

Captain's Watch

- Crews on the captain's watch are obtaining about 6.4 hours of sleep (with 8.1 hrs TIB) per 24 hr. day
- Crew on the captain's watch were sleeping more (about 3.7 hours) during the anchor sleep period from about 00:00-06:00, and they usually were able to take a 2-3 hr nap during the 12:00-18:00 sleep period.
- This is in line with the circadian propensity to sleep during the night and nap in the afternoon.
- **This finding makes it very unlikely that crew on a 7:7:5:5 or an 8:8:4:4 watch schedule would obtain close to 7 or 8 hours of sleep even when a sleep period coincided with a 7- or 8-hour rest period.**
- Crews would still have to develop a "napping" strategy as do crews on a 6:6:6:6 watch with less time (4 or 5 hours) to place their nap sleep.

After Watch

- Crews on the after watch were sleeping about 6.2 hr per 24-hour day, which was only slightly less than crew members on the captain's watch.
- After our intervention on days 6-10 of the study period the total sleep on the after watch increased and was the same as crew sleep durations on the captain's catch, although the data did not reach statistical significance due to the small sample size.

Future Plans

- Develop, implement and test a napping/anchor sleep intervention program (integrated with CEMS program)
- Obtain objective sleep data on towboats on each schedule 6:6:6:6 or 7:7:5:5 for 10 days
- Select “homogenous” towboats on 6:6:6:6 or 7:7:5:5 that were part of the towboat study. Over the same 10 day schedule monitor sleep during “intervention/sleep hygiene” program
- Across-industry comparison