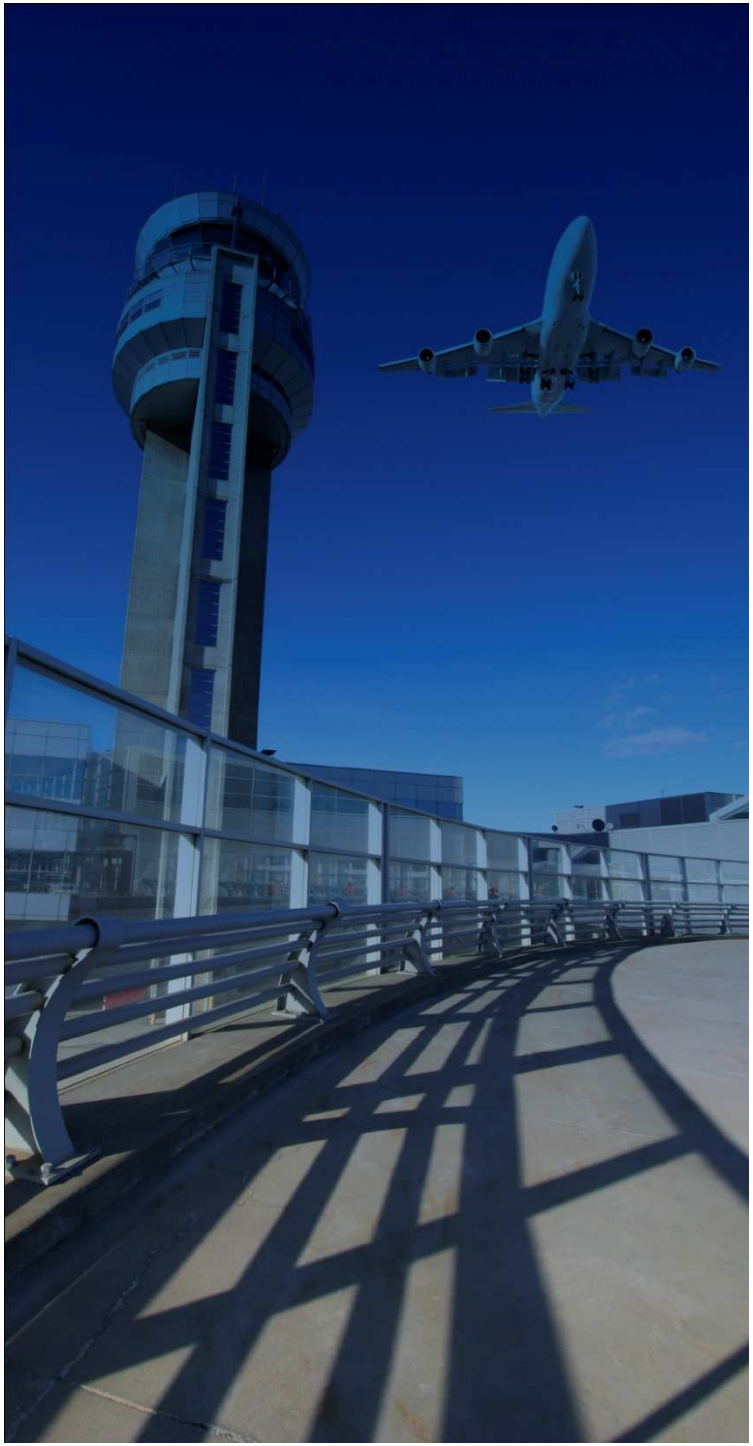
Article 55
Fatigue Risk Management Work Group

Recommendations

Communicating for Safety

March 23, 2011



Article 55 FRM Task and Focus

CBA Tasking

- Develop a fatigue management system
- Identify and mitigate workplace fatigue concerns
- Refer recommendations for action

Work Group Focus

- Increase safety of the NAS
- Improve the health and well being of our workforce
- Base findings/recommendations on **Science and Data**
- Collaborate with internal and external organizations

Collaboration

A55 Core Membership

- FAA
  - *Duane Dupon*
  - *Rick Huss*
  - *Mike Medley*
  - *Ken Myers*
- NATCA
  - *Phil Barbarello*
  - *Nick Collins*
  - *Ginger Demakos*
  - *Peter Gimbrere*
  - *Dean Iacopelli*
  - *Jeff Richards*

FAA Support

- Aerospace Medicine
- ATO Human Factors Research and Engineering Group
- ATO Office of Safety
- ATO Office of Technical Training
- CAMI
- Flight Standards
- SUPCOM

Expert Support

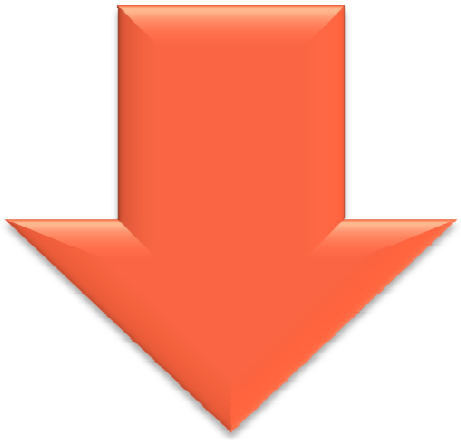
- NASA
- Air Force Research Laboratory
- Fusion Sleep
- Institutes for Behavior Resources
- Virtual Flight Surgeons
- MITRE
- DB&A
- CSSI
- SENTEL

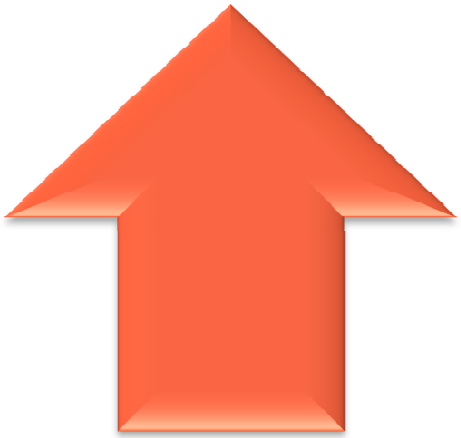
FAA Advisory Circular Fatigue Definition

Fatigue refers to a physiological state in which there is:

- **Decreased capacity** to perform cognitive tasks
- **Increased variability** in performance

Capacity to Perform





Variability in Performance

Fatigue Impacts

Physiological & Cognitive

- **Accuracy and timing degrade**
- **Involuntary micro-sleeps**
- **Attention wanes**

Source: *Caldwell, et al. Fatigue Countermeasures in Aviation. Aviation Space Environment Med 2009; 80:29-59.*

Individual Performance

- **Loss of situational awareness**
- **Increased risk of errors**
- **Performance declines**

Source: *David F. Dinges, Ph.D., University of Pennsylvania School of Medicine, Investigating Fatigue Factors, Sept 2010.*

Productivity

- **Increased absenteeism**
- **Higher operational costs**

Source: *Journal of Occupational & Environmental Medicine: Jan 2010 - Volume 52 - Issue 1 - pp 91-98*

Aviation Safety

- **14 accidents with 263 fatalities since 1993 with fatigue as a causal or contributing factor**

Source: *NTSB Data, Sept 2010.*

Fatigue Drivers and Causal Factors

Fatigue Drivers

- Circadian rhythm
- Amount of time since last sleep period
- Quantity/quality of sleep
- Task intensity/workload

Causal Factors

- Workplace elements
- Personal elements
- Individual differences/ biological factors

Source: Fatigue Risk Management System for the Canadian Aviation Industry: An Introduction to Managing Fatigue, April 2007

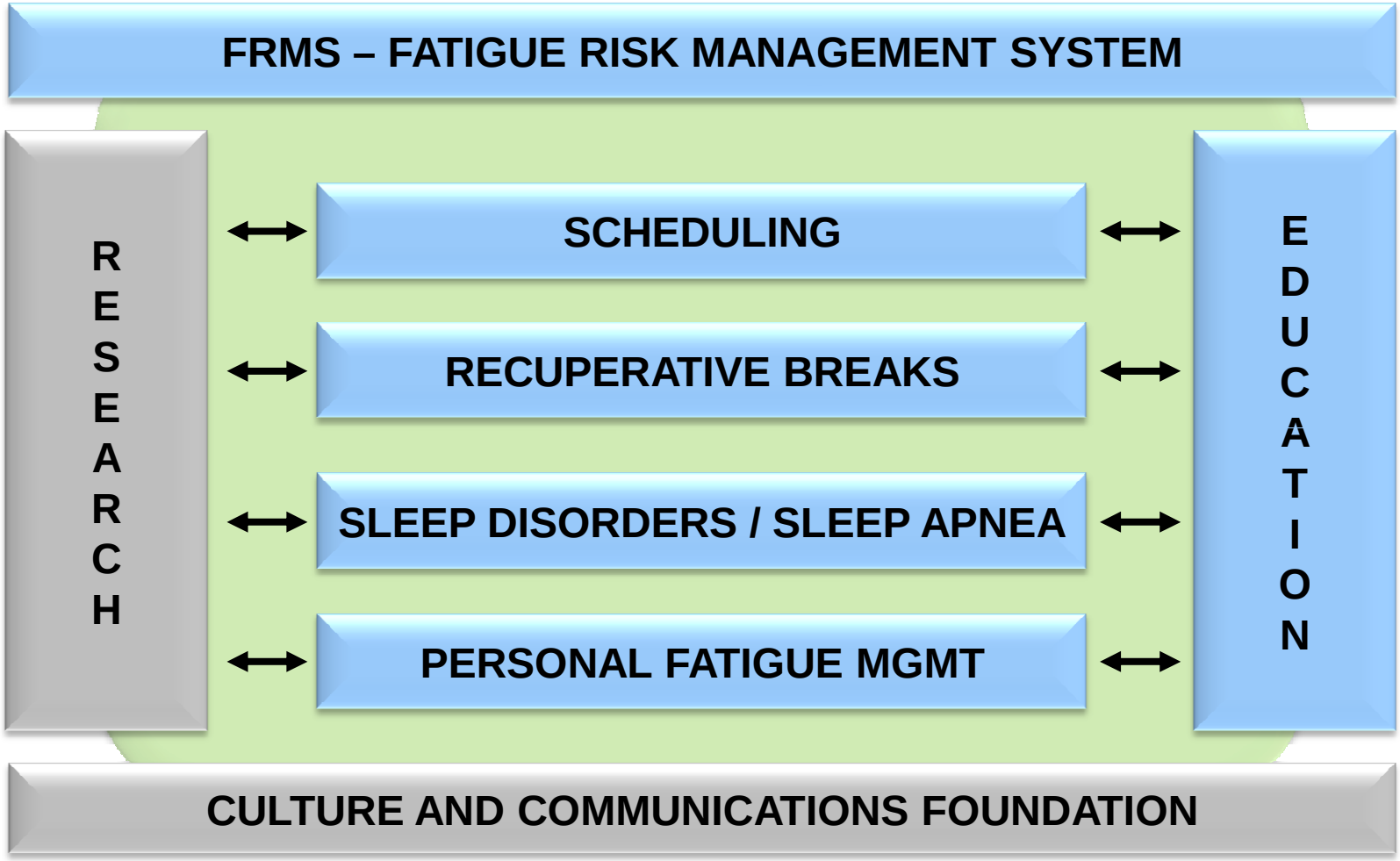
FAA ATC Operational Demands

- **Shift work contributes to cumulative fatigue***
- **Agency mission requires shift work**
  - 51% of federally operated Terminal facilities are 24/7 **
  - 100% of En Route facilities are 24/7 **
  - 22% of controllers worked a mid shift during the first 21 pay periods of year 2010***
- **Acute fatigue occurs on a daily basis due to reduced sleep opportunity**
- **Task intensity, time on task and workload contribute to acute fatigue**

** Source: DOT Commercial Transportation Operator, Fatigue Management Reference, July 2003*
*** Source: FAA Digital Terminal Resource Book Facility Report Database - obtained Oct 7, 2010*
**** Source: Cru-ART data, Nov 11, 2010*

RECOMMENDATIONS FOR CONSIDERATION

A55 FRM Recommendation Framework



Scheduling and Recuperative Breaks

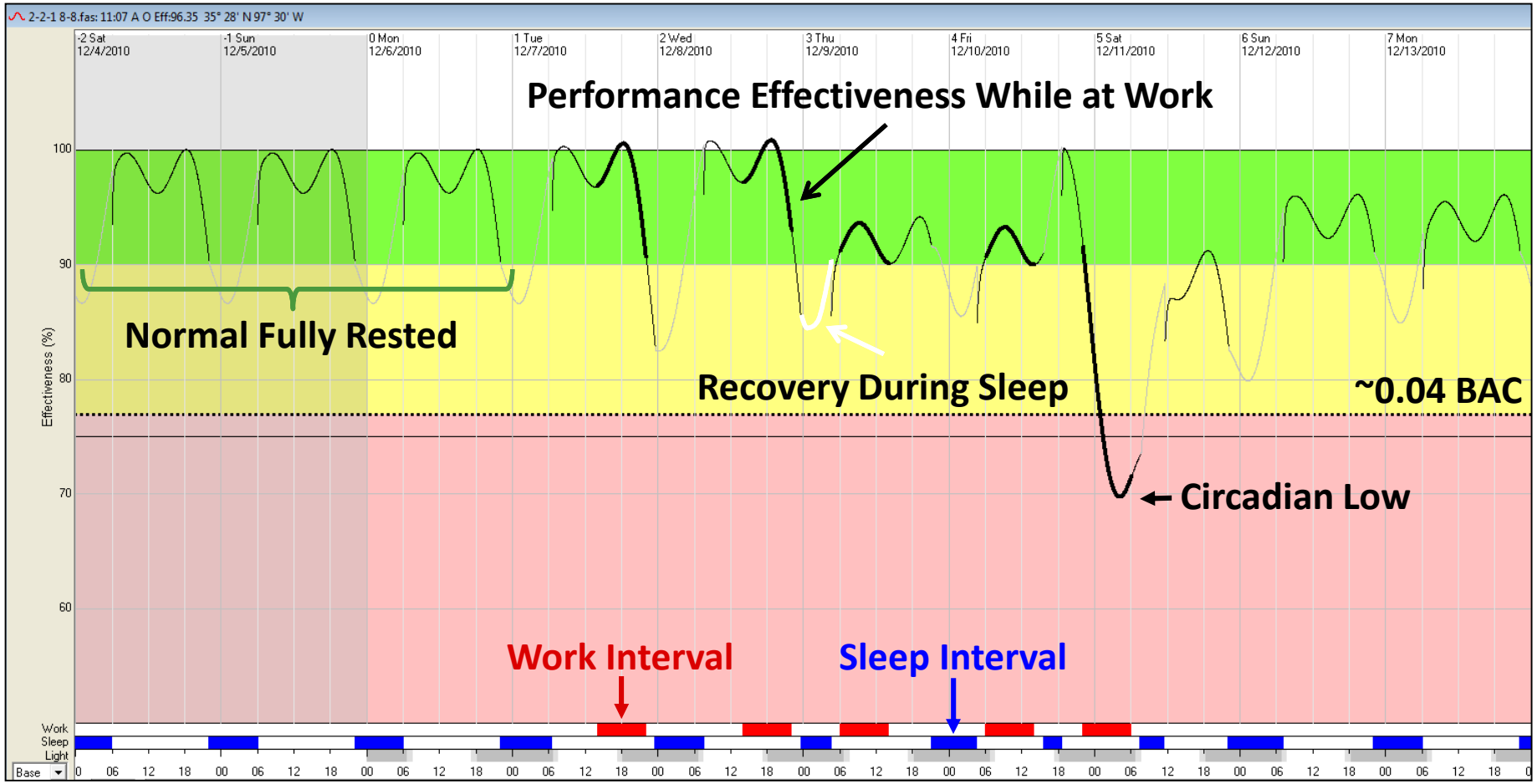
Scope:

- To what degree do ATC schedules induce fatigue?
- What schedules provide increased cognitive performance and opportunity for restorative rest over a six week timeframe?

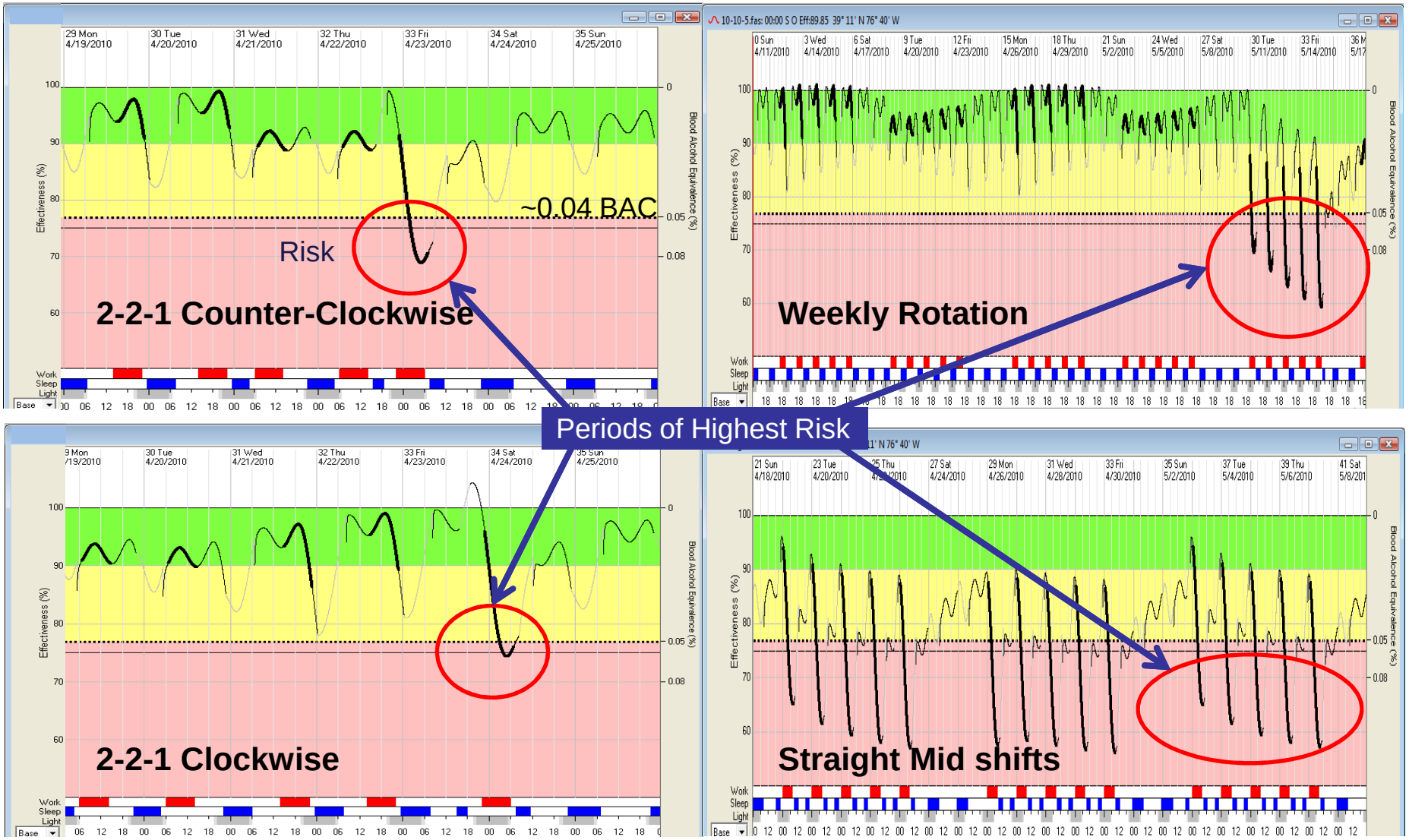
Methodology:

- Identified most *widely used schedules*
- Modeled *110 schedule and nap permutations* to identify risk
- Modeled *alternative work schedules* that increased opportunities for *restorative night time* sleep between shifts within the current *40 hour work week*
- Comparatively analyzed modeling results to *measure the effect of proposed countermeasures* and schedule adjustments

Modeling Performance – FAST Output



Fatigue Risk in Schedules

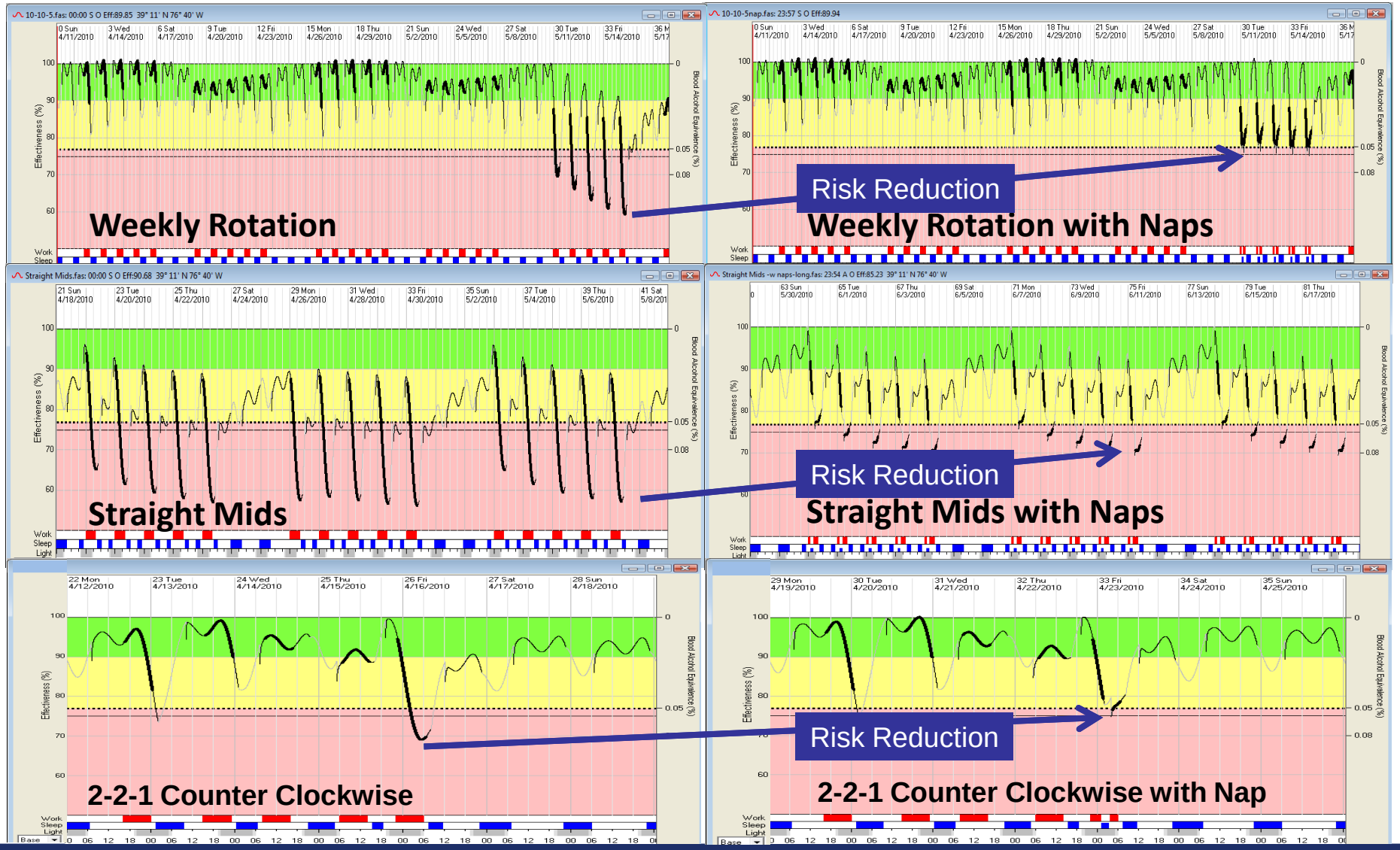


Recuperative Breaks

Background:

- **Sleep Opportunity**
  - Greatest risk on any schedule is during mid shift
  - Sleep pressure becomes intense, esp. on mid shift
  - Naps increase alertness and performance
  - Proactive naps prior to a mid shift prove beneficial
- **Sleep Inertia**
  - Short term performance impairment following sleep
  - Needs to be addressed prior to returning to duty
  - Personal mitigation techniques further reduce inertia (e.g.; exercise, hydration, light exposure, caffeine)

Modeled Nap Benefit on Midnight Shifts



RECOMMENDATION #1
Recuperative Breaks

Findings:

- Fatigue can occur at any time and on any shift
- Introducing a sleep opportunity during a shift can mitigate the risk of reduced cognitive performance due to fatigue

Recommendation:

**Modify current policy, orders, etc.,
to permit naps during relief periods (breaks).**

RECOMMENDATION #2
Recuperative Breaks

Finding:

- Introducing a sleep opportunity on the mid shift can mitigate the identified risk of reduced cognitive performance due to fatigue
- Sleep inertia must be accounted for in recuperative break planning, execution and management

Recommendation:

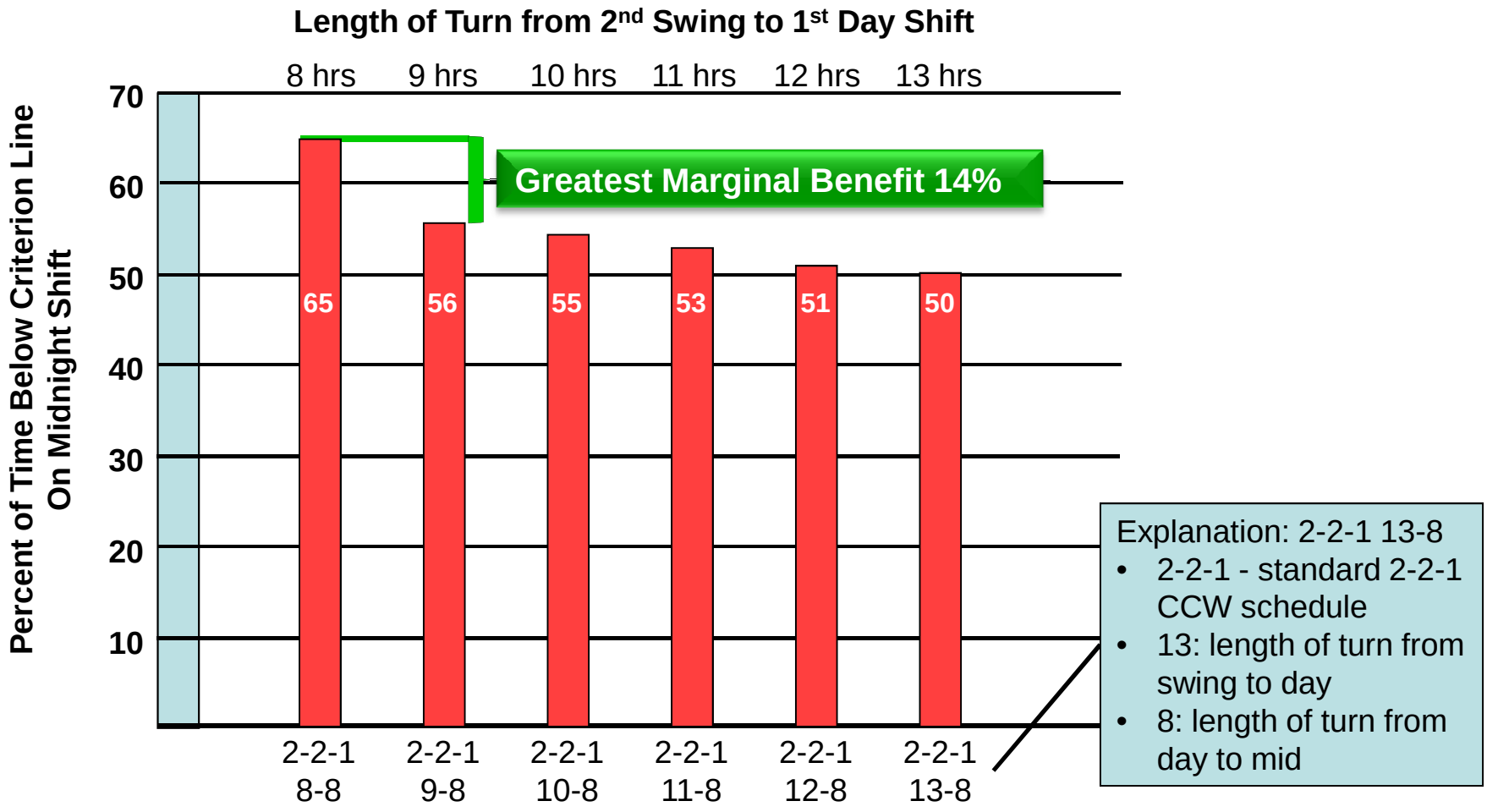
In addition to normal breaks on midnight shifts, include a provision for a recuperative break for 2½ hours, which incorporates time to overcome sleep inertia should an employee choose to nap.

Scheduling

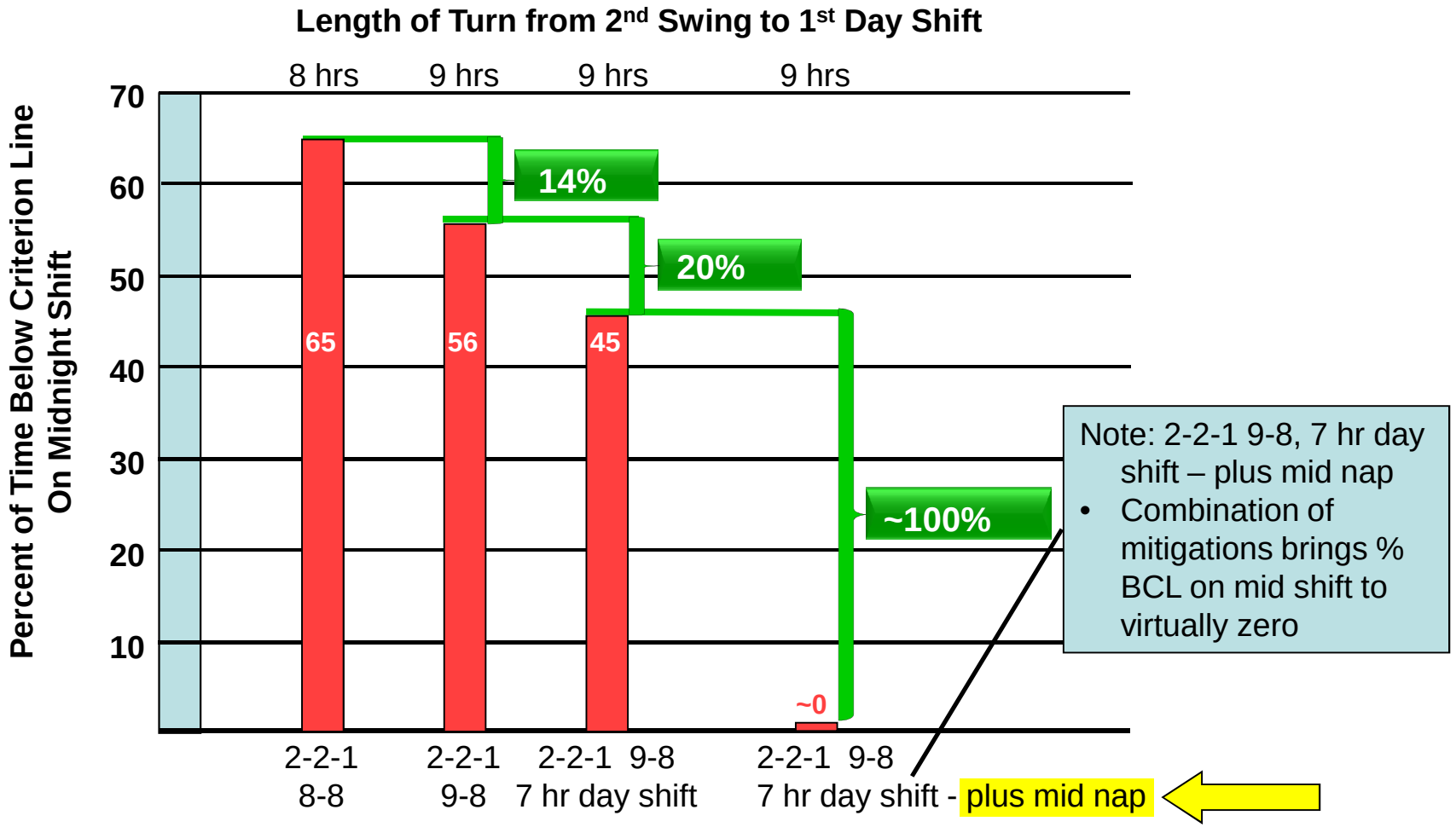
Background:

- Fatigue is one of the consequences of shift work
- Fatigue risk is particularly high during time periods around circadian low
- Because of circadian factors, some risk on midnight shifts is unavoidable, but the degree of risk can be mitigated with a range of techniques

2-2-1: Benefit of 9 hr Turn From Swing to Day



2-2-1: Benefit of 9 hr Turn From Swing to Day PLUS: 7 hr 2nd day shift with 1 hr later start PLUS: 2 hr nap on mid



RECOMMENDATION #3:
Increase Night Time Sleep Opportunity

Findings:

- Quick turns between evening and day shifts reduce opportunities for night time restorative sleep
- On a 2-2-1, increasing the time between the second evening and the first day shift by one hour increases sleep opportunity and cognitive performance

Recommendation:

Provide a minimum of nine (9) hours between evening and day shifts.

RECOMMENDATION #4:
Increase Night Time Sleep Opportunity

Findings:

- Increasing night time sleep opportunity during the night prior to the second day shift and subsequent mid results in significant fatigue risk reduction during the mid shift
- The placement of the one hour from the reduced shift into a previous evening or day shift has no effect on this risk reduction benefit

Recommendation:

On a 2-2-1 CCW rotation, reduce the day shift preceding the first midnight shift from eight to seven hours, and begin that shift one hour later, to provide the opportunity for an extra hour of restorative sleep at the end of the night time sleep period.

Sleep Apnea (SA)

Scope:

- Does unreported sleep apnea present a fatigue risk to the NAS?

Methodology:

- Collaborated with FAA Aerospace Medicine (AAM)
- Identified the level of SA reporting in the ATC workforce
- Reviewed sleep disorders research
- Engaged sleep disorders experts
- Identified standard American Academy of Sleep Medicine (AASM) practices

RECOMMENDATION #5: Address Sleep Apnea (SA)

Findings:

- Per AAM - 2.2% of ATC workforce have diagnosed SA, and estimate that a minimum of an additional 1.8% may be undiagnosed
- Perceived non-standardized processes, as well as a lack of awareness of sleep disorders and treatments, may result in financial disincentives and unreported sleep apnea in the ATC workforce

Recommendation:

Create policies and procedures that encourage self-initiated evaluation, diagnosis and demonstration of initial treatment effectiveness of SA by removal or reduction of economic disincentives.

RECOMMENDATIONS #6: Address Sleep Apnea (SA)

Findings:

- There is a gap in awareness and understanding of sleep apnea among the controller workforce
- Raising awareness and understanding of sleep disorders will reduce the risk to the NAS

Recommendation:

Use AAM-prepared SA education to build Sleep Apnea awareness in ATO workforce, include raising awareness of respiratory coaching to SA patients.

RECOMMENDATION #7: Address Sleep Apnea

Finding:

– The scope of this issue requires collaboration across respective lines of business

Recommendation:

Aerospace Medicine

- **AAM to stay current with state of the art in sleep medicine.**
- **AAM to utilize AASM standards and practices for SA risk factor identification, diagnosis and treatment standards.**
- **AAM to document the process for medical qualification for individuals at risk for sleep apnea.**
- **AAM to develop educational materials for the workforce and AMEs.**
- **AAM to educate AMEs on SA.**

Personal Fatigue Management

Scope:

- How can controllers self-declare when they are too fatigued to safely fulfill their duties?

Methodology:

- Reviewed FAA and DOT policies and procedures related to use of leave for rest and/or fatigue
- Researched external organizations and regulators and identified explicit policies and procedures that allow employees to self-declare fatigue

Background:

- HRPM ER-4.1:
  - Requires an employee to report for duty "…in a mentally alert condition to perform the duties of his or her position"
  - Prohibits the use of "sick leave for rest…"

Personal Fatigue Management

Statement of Principle

All operational personnel are obligated by their significant safety duties and professional responsibilities to prepare for duty with consideration for being well-rested and mentally alert. However, we recognize that there may be circumstances where an employee is fatigued, and the use of leave, including sick leave, is appropriate.

Personal Fatigue Management

Findings:

- Managers and controllers do not fully understand:
  - Respective **roles and responsibilities** as it relates to fatigue, and minimizing associated fatigue risks
  - **Actions to be taken** when controllers consider themselves too fatigued to safely perform their duties
- Management and controllers need a **clear and commonly understood process to allow controllers to be relieved of their operational duties when they are too fatigued to safely perform them**
- A **standards-based, non-punitive response process** is needed when controllers self-declare they are too fatigued to safely perform their operational duties
- Self-declaration of fatigue should be managed in a non-punitive manner in the **context of just culture**

RECOMMENDATION #8:
Personal Fatigue Management

Finding:

- Controllers may not fully understand their responsibilities to minimize fatigue, and actions to be taken when they consider themselves too fatigued to safely perform their operational duties

Recommendation:

Develop policy and education for employees defining responsibilities to minimize fatigue and report fit for duty, and action to be taken when they consider themselves too fatigued to safely perform their duties.

RECOMMENDATION #9:
Personal Fatigue Management

Finding:

- Managers may not fully understand their responsibilities related to interacting with controllers who report that they are too fatigued to safely perform their duties

Recommendation:

In order to avoid on-the-job fatigue that threatens safety, develop policy and education for managers that incorporates emphasis on a non-punitive approach when an employee, in accordance with the developed policy, self-declares as too fatigued to safely perform operational duties.

RECOMMENDATION #10:
Fatigue Awareness Training

Finding:

– Controller fatigue awareness training does not comprehensively capture current science, personalize fatigue mitigation strategies, or support practical operational needs

Recommendation:

Update existing fatigue awareness training to reflect current science and to personalize the application of the training.

Fatigue Risk Management System (FRMS)

Scope:

- How can we strategically manage fatigue risk in the ATC operational environment?

Methodology:

- Examined FAA policy and structures used to manage fatigue risk in the ATC workforce
- Explored shared responsibility in managing fatigue
- Reviewed how other regulators, industries and organizations managed fatigue risk

Aviation Industry FRMS - Global Acceptance

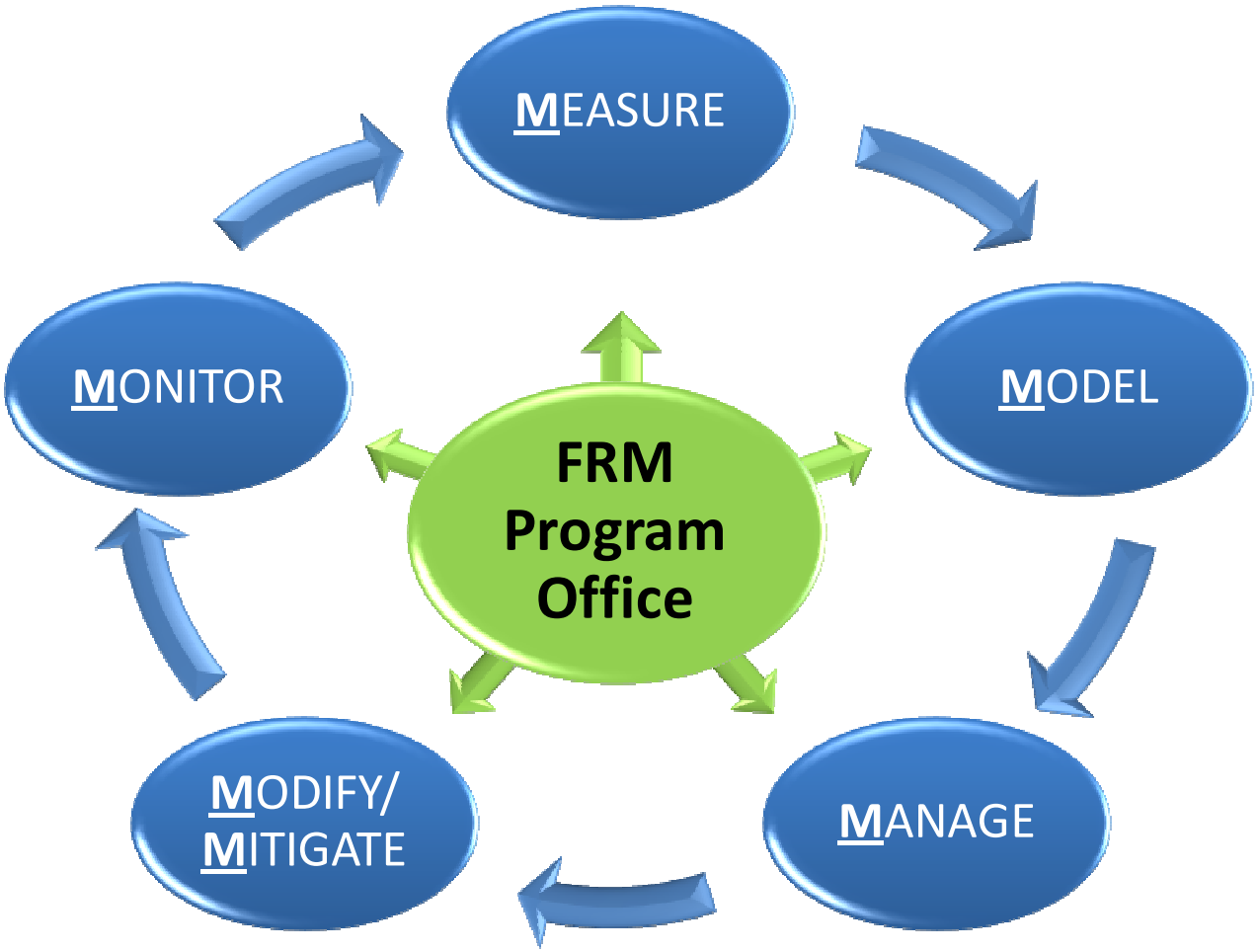
Domestic environment:

- Air carriers with FRMS: United, Delta, US Airways, DHL, Express Jet, Continental
- Regulators: Nuclear Regulatory Commission
- FAA – issued Advisory Circular 120-103, Fatigue Risk Management Systems for Aviation Safety (August 2010)

International environment:

- Air carriers with FRMS: Quantas, Air New Zealand, Emirates, easyJet
- Regulator/Service Provider: Transport Canada, NavCanada
- ICAO FRMS task force - drafted provisions for regulators to introduce FRMS regulations (June 2010)

Proposed FRMS Process



Based on Five M Model, Hursh - 2008

RECOMMENDATION #11:
Fatigue Risk Management System (FRMS)

Finding:

– A formal Fatigue Risk Management System (FRMS) institutes a continuous, repeatable, collaborative process to identify, analyze and mitigate fatigue risks

Recommendation:

Design and implement a Fatigue Risk Management System (FRMS) within the FAA operational ATC environment.

RECOMMENDATION #12: FRMS Transition Team

Finding:

- Retention of organizational knowledge supports a successful transition from the current A55 FRM Work Group to the implementation of an approved FRMS

Recommendation:

Continue to support the post-recommendation work streams by creating a transition team composed of A55 FRM Work Group members until the formal FAA FRMS is established for ATC.

Recommendations Potential Benefits

A55 FRM Recommendations Equip the FAA to:

- Systematically manage ATC fatigue risk
- Reduce acute and chronic sleep debt
- Improve opportunities for nighttime sleep
- Improve ability to obtain restorative sleep
- Allow for the self-declaration of fatigue
- Gather data to support fatigue analysis and mitigations
- Educate the workforce on personal and professional responsibilities in reducing fatigue, and
- Support the ongoing adoption of a positive Safety Culture

Next Steps

The Parties agreed to collaboratively examine the implementation considerations for all 12 recommendations, with a joint work team that will deliver Questions and Answers within 90 days of initial meeting.

Conclusion

- **A55 tasking review**
- **Effective collaboration**
- **Supportive of safety culture**
- **Shared responsibility**
- **Education, training and communication are key**
- **Multi-year process**

Backups

Controller Fatigue--The Tasking

- **Article 55, Section 3:**
  - Within sixty (60) days of the signing of this Agreement, the Parties agree to **establish a workgroup to develop a fatigue management system**. The workgroup shall consist of at least three members from each Party. The scope of the workgroup will be **to identify and mitigate work place fatigue concerns**. Recommendations reached within the workgroup shall be referred to the parties for such action as they deem appropriate. Any bargaining obligations shall be handled in accordance with Article 7 of this Agreement. *

*Source: Controller Collective Bargaining Agreement, dated Oct 2009, Article 55, Section 3

NTSB Safety Recommendations A-07-30 & 32

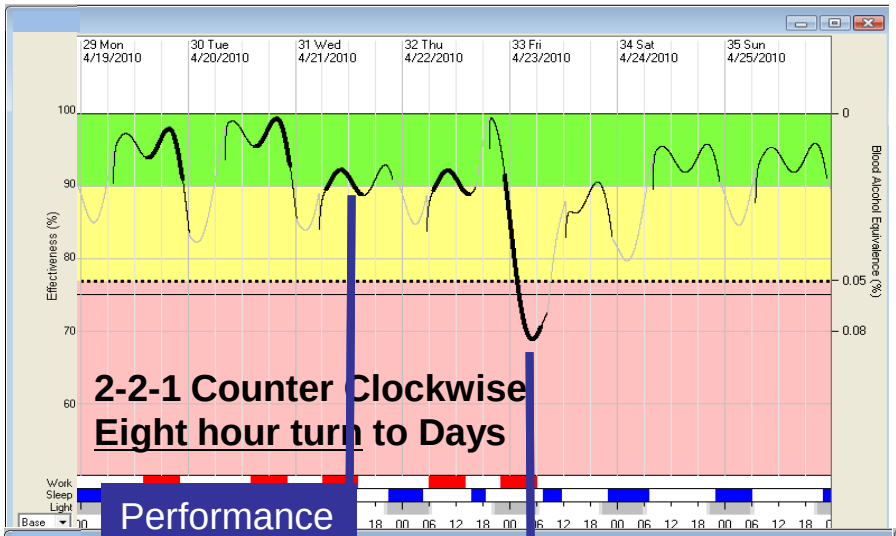
- **A-07-30 & 32: Issued to FAA & NATCA: April 10, 2007 - OPEN**

  Federal Aviation Administration and the National Air Traffic Controllers Association work together to reduce the potential for controller fatigue by:

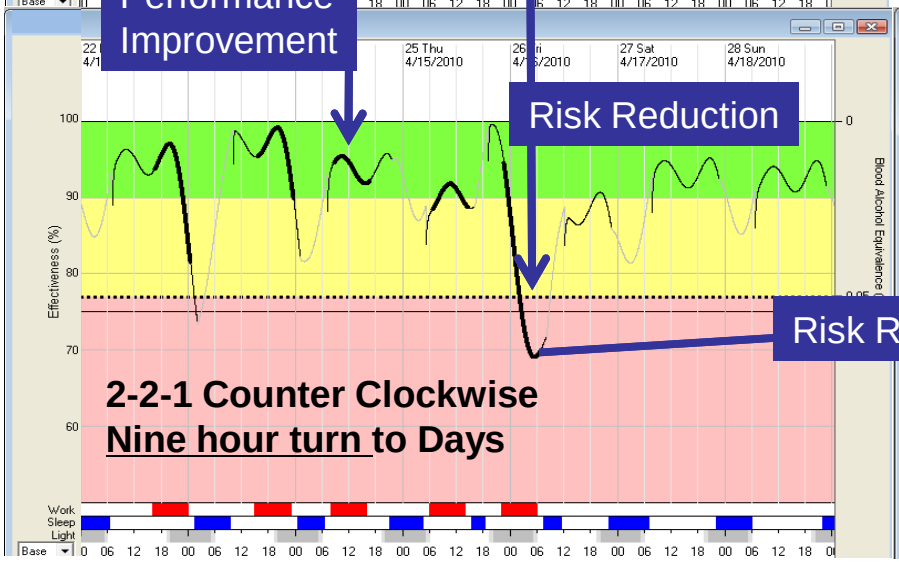
  1. ***revising controller work-scheduling policies and practices to provide rest periods that are long enough for controllers to obtain sufficient restorative sleep, and by;***

  2. ***modifying shift rotations to minimize disrupted sleep patterns, accumulation of sleep debt, and decreased cognitive performance.***

2-2-1 Schedule Adjustments

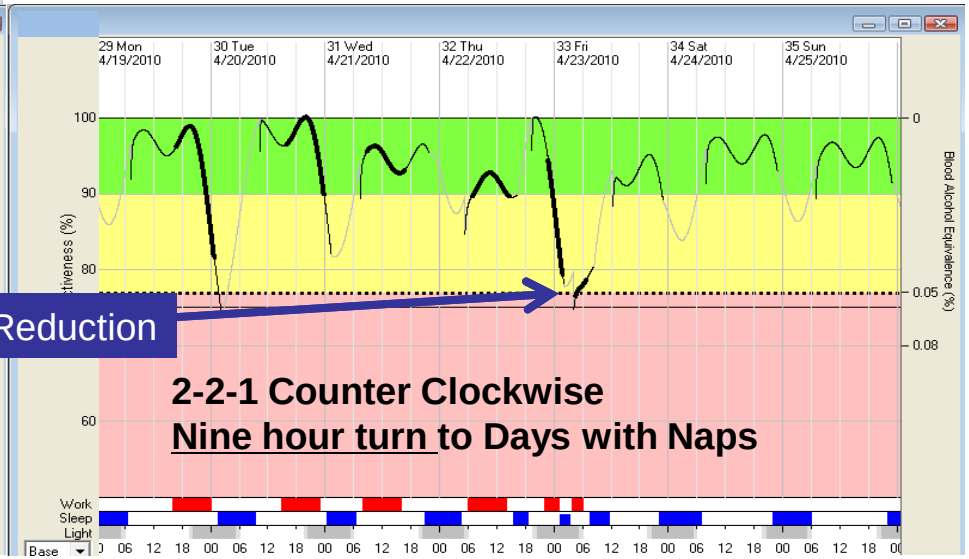


Performance Improvement



Risk Reduction

Risk Reduction



- **Nine hour turn improves day performance with slight improvement on Mids**
- **Adding recuperative breaks (with sleep) further reduces risk on Mids**

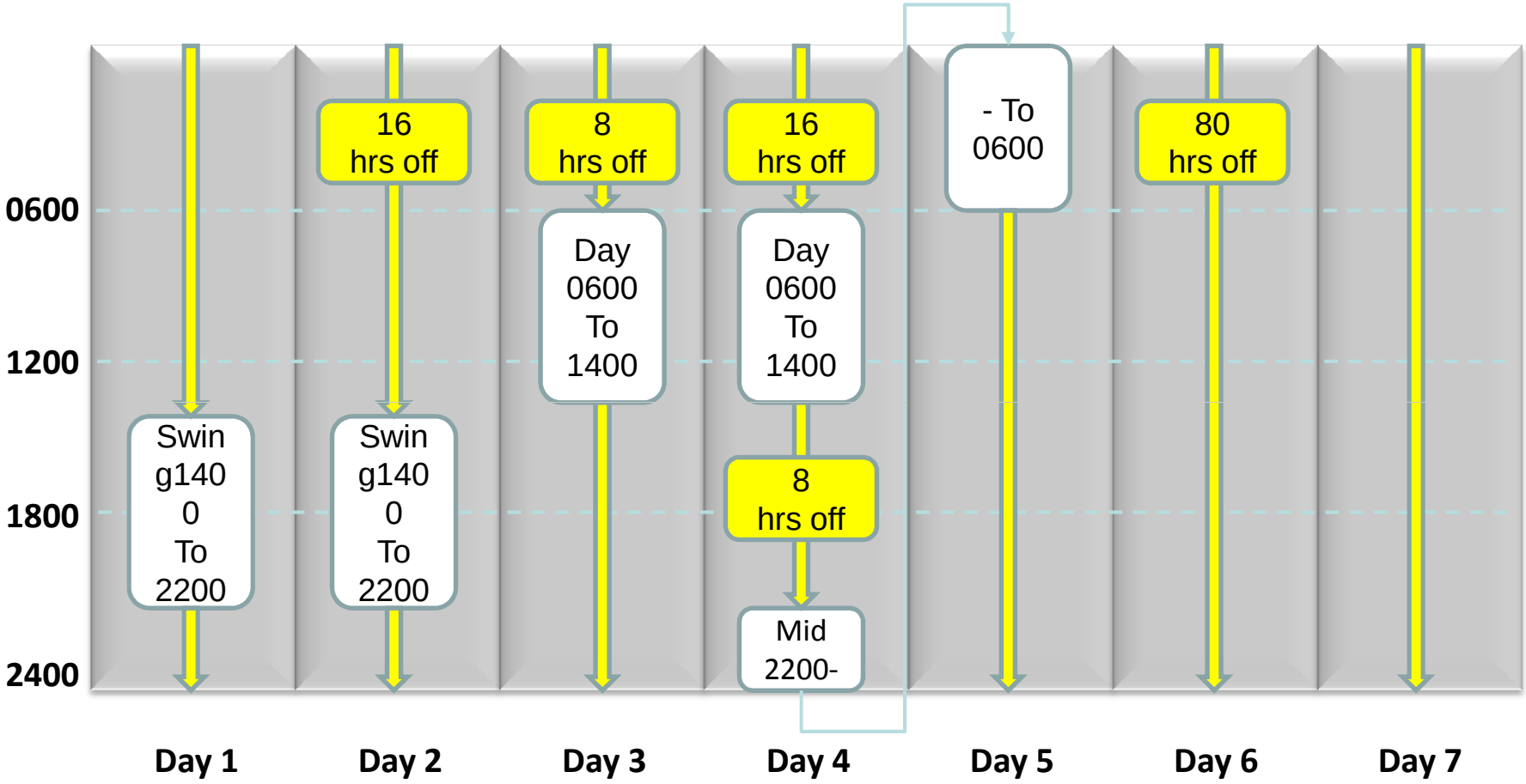
Blood Alcohol Concentration (BAC) Scale

The effects of fatigue may be compared to the effects of blood alcohol to illustrate the severity of fatigue

Continuous Hours of Wakefulness	*FAST* Effectiveness	Blood Alcohol Concentration (BAC)
18.5	77	0.04 - 0.05
21	70	0.08

Sources: Arnedt, J.T., et al "How do prolonged wakefulness and alcohol compare in the decrements they produce on a simulated driving task?" *Accident Analysis Preview,* 2001 May;33(3):337-44.
Dawson, D., Reid, K., 1997. "Fatigue, alcohol and performance impairment." *Nature* 388, 23.

Generic Counter Clockwise Rotating 2-2-1



Fatigue Risk Management System (Notional)