THE NIGHT SHIFT:

CAN WE COMPLETELY ADAPT AND HOW?

Circadian Rhythms & Coast Guard Flight Operations

By LCdr. Mike Staier, USCG

Scenario One:

In August 1993, a DC-8 crashed in broad daylight in Guantanamo Bay, Cuba. The crew had been awake for 19 to 23.5 hours; the effects of fatigue and the completion of this nine-hour leg proved too much. The pilot fixated on the white strobe that marks the fence line, dividing Communist Cuba and the American-leased air base. A high angle-of-bank and deteriorating airspeed gave no indication the pilot had made any corrective actions before crashing one-quarter mile from the intended landing zone.

What's remarkable about this mishap? It's one of the first times the National Transportation Safety Board (NTSB) cited fatigue, inadequacy of flight, and duty-time regulations as causes.

Typical Coast Guard mission scenarios call for low, night and overwater flights, which require hovering over pitching and swaying masts of fishing or sailing vessels. Coast Guard aviators are called upon at all hours of the day or night, in the most miserable weather conditions, to save lives and property or to protect the homeland. A good night's sleep is a rarity.

Scenario Two:

Another standard scenario is reverse-cycle-operation (RCO) deployments. These deployments are designed to maintain an air presence during nighttime hours, primarily in support of counter-narcotic operations, fisheries law enforcement, or homeland security.

So, you're a JO, assigned to the schedules office at a group or air station, tasked with creating a special operation with a focus on nighttime surveillance. What do you need to know? How do you get the most from the aircrews while keeping them safe?

Can your crews adapt completely to the "night shift"? What can you do in advance, and during the deployment, to ease the transition?

Background

The most common performance challenges of night-shift work come from the human biological clock or cycles. Three main cycles, or rhythms, have been identified: ultradian (20 hours or less), circadian (20 to 28 hours), and infradian (28 hours or more). Circadian comes from the Latin (*circa*, about; *dies*, day) and is based on the human internal-body clock that runs on a schedule of about 24 hours. To understand this 24-hour cycle, let's look at what influences it.

Sleep Influences

• **Biological factors** include the rise and fall of human-body temperatures throughout the day and the daily cyclical production of different hormones. Human-body temperatures can vary by nearly five percent in a single 24-hour period. A low temperature peak at approximately 4 a.m. and a high temperature peak near 5 p.m. coincide with a crewman's typical alertness extremes.

• **The social cycle** is dictated by societal norms, such as when the smell of breakfast wafts into your dream, or when the garbage collector tumbles the trash cans down the street. It's difficult to overcome these sleep influences, even with reduced light and noise for daytime sleeping. The clock on the wall, habitual sleep, meal times, and work and leisure activities are prime examples of social time cues. People seldom or never adjust completely to the night shift or to a new rhythm. The only way to adapt fully to RCO schedules is to reset your biological clock so your energy peaks during nighttime. Since this adjustment requires bright light in the workplace, flight crews only partly can adapt.

Challenges

Operational commanders face many challenges during the planning phases of an RCO deployment. Typically, the air station that owns the airframe and crew does not maintain tactical control of the asset. The aircrew may work for other Coast Guard entities, such as a cutter or group. Before a deployment, schedulers should discuss mission objectives, scheduling, crew accommodations, and environmental considerations to make sure crew endurance is managed properly.

Close consideration of sortie length, mission times, and crew motivation is crucial.

• Keep **sortie length** to a minimum. Schedulers should keep in mind that a two-hour sortie can mean being awake six hours during the middle of the night. Two hours of flight time does not equate to two hours of work.

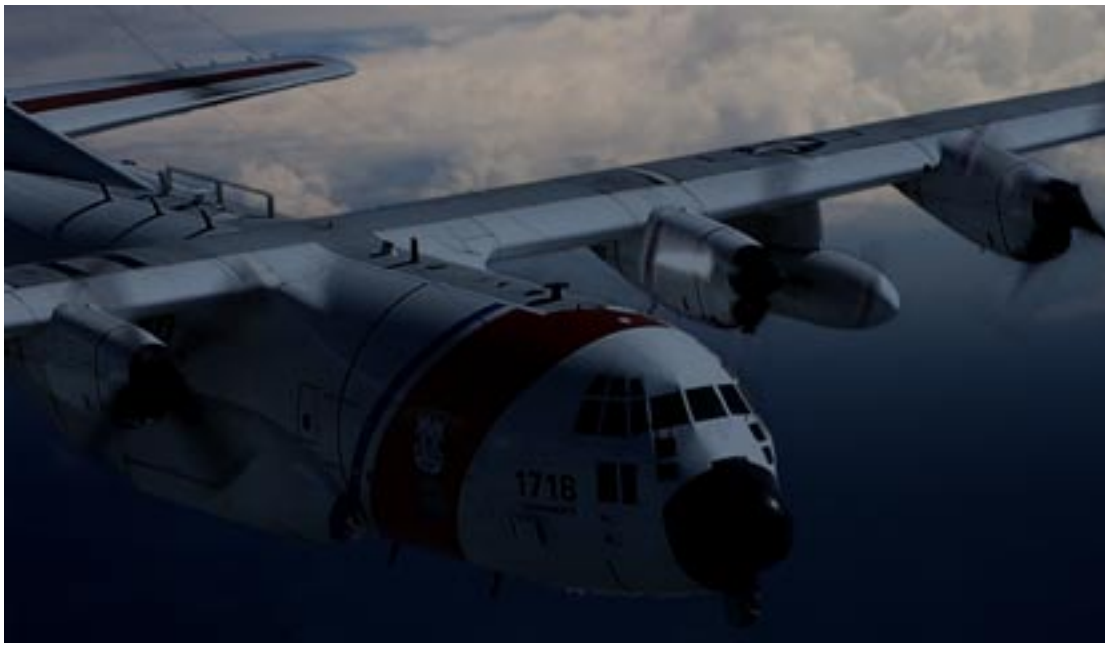
• Evaluate **mission time** scheduling with sortie length. When practical, tactical commanders should schedule RCO patrols, one per night, so that a nap, preferably during darkness, may be taken before flight. Patrols during the early morning hours should be avoided from 4 a.m. to 6 a.m., when sleepiness peaks.

• **Crew motivation** and commitment to the reversed cycle are important when adjusting your circadian rhythm to night work. Total commitment is rare and hardly can be expected, considering the social difficulties involved. Typically, a crew of four to seven people is cohesive and enjoys dining and taking part in other activities together. However, a task that normally would take one person 20 minutes to do, such as eating, can take considerably longer when more people are added to the mix. Socializing is best saved for lively discussions during the sleepiness peak.

Three main factors influence the likelihood of unintended sleep during a duty shift:

1) circadian rhythm,
2) quality of the last sleep,
3) time since the last sleep cycle.

Sleeping at the right times, in best coordination with the circadian rhythm, is referred to as having good **sleep hygiene**. Postflight sleep should be coordinated with the circadian rhythm. Studies show daytime sleep periods are typically 41 percent (three hours) shorter and less restorative than nighttime sleep. A shift from the normal sleep, work, leisure schedule to one of work, leisure, sleep is required to allow sleep during the normal afternoon trough in body temperature and peak



in error tendency. The latter scenario is preferred if the crew cannot complete the sortie and return to their sleep rooms before sunrise. Studies show a moderate error peak around 3 p.m., with a much more severe error peak around 3 a.m.

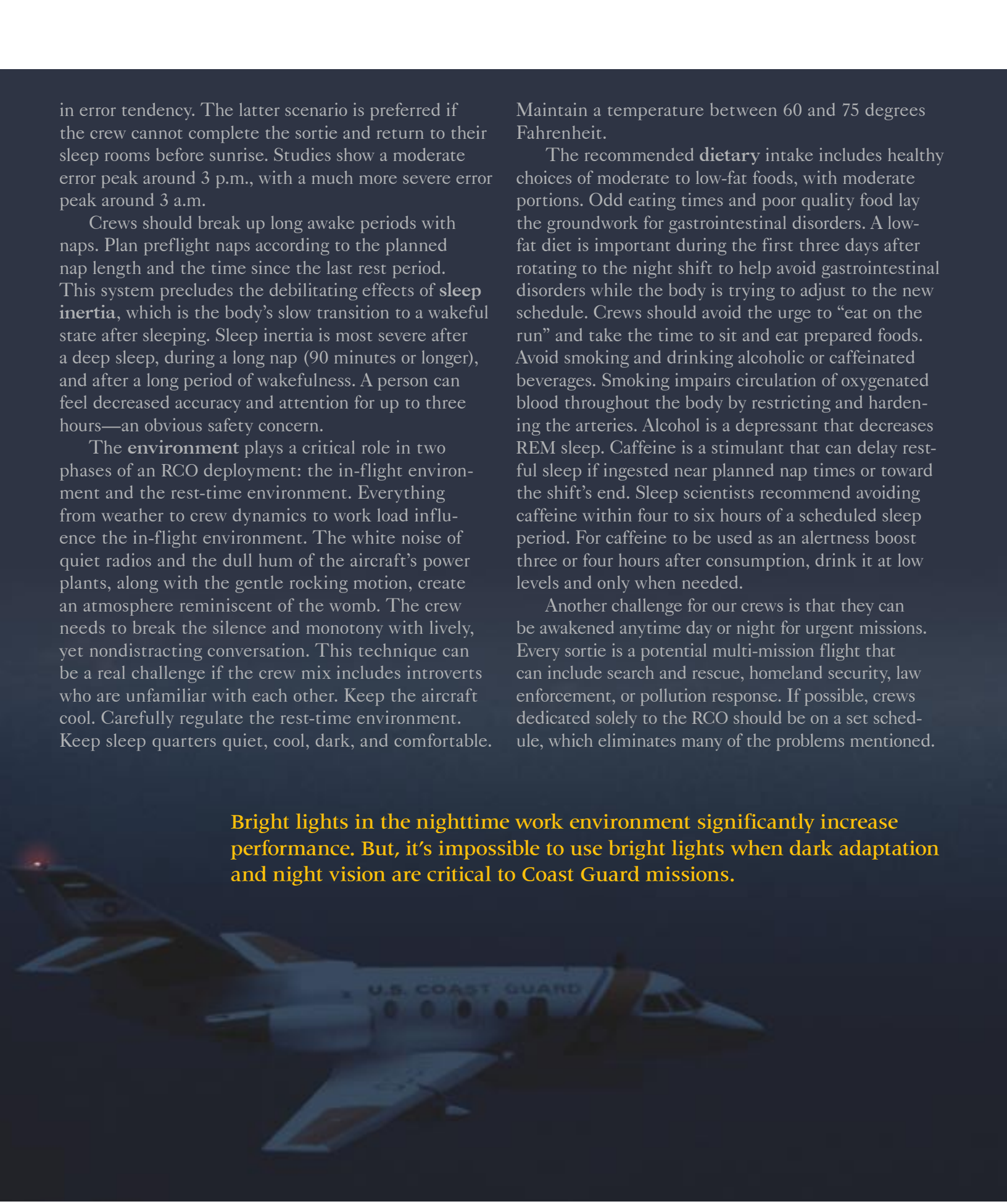
Crews should break up long awake periods with naps. Plan preflight naps according to the planned nap length and the time since the last rest period. This system precludes the debilitating effects of **sleep inertia**, which is the body's slow transition to a wakeful state after sleeping. Sleep inertia is most severe after a deep sleep, during a long nap (90 minutes or longer), and after a long period of wakefulness. A person can feel decreased accuracy and attention for up to three hours—an obvious safety concern.

The **environment** plays a critical role in two phases of an RCO deployment: the in-flight environment and the rest-time environment. Everything from weather to crew dynamics to work load influence the in-flight environment. The white noise of quiet radios and the dull hum of the aircraft's power plants, along with the gentle rocking motion, create an atmosphere reminiscent of the womb. The crew needs to break the silence and monotony with lively, yet nondistracting conversation. This technique can be a real challenge if the crew mix includes introverts who are unfamiliar with each other. Keep the aircraft cool. Carefully regulate the rest-time environment. Keep sleep quarters quiet, cool, dark, and comfortable. Maintain a temperature between 60 and 75 degrees Fahrenheit.

The recommended **dietary** intake includes healthy choices of moderate to low-fat foods, with moderate portions. Odd eating times and poor quality food lay the groundwork for gastrointestinal disorders. A low-fat diet is important during the first three days after rotating to the night shift to help avoid gastrointestinal disorders while the body is trying to adjust to the new schedule. Crews should avoid the urge to "eat on the run" and take the time to sit and eat prepared foods. Avoid smoking and drinking alcoholic or caffeinated beverages. Smoking impairs circulation of oxygenated blood throughout the body by restricting and hardening the arteries. Alcohol is a depressant that decreases REM sleep. Caffeine is a stimulant that can delay restful sleep if ingested near planned nap times or toward the shift's end. Sleep scientists recommend avoiding caffeine within four to six hours of a scheduled sleep period. For caffeine to be used as an alertness boost three or four hours after consumption, drink it at low levels and only when needed.

Another challenge for our crews is that they can be awakened anytime day or night for urgent missions. Every sortie is a potential multi-mission flight that can include search and rescue, homeland security, law enforcement, or pollution response. If possible, crews dedicated solely to the RCO should be on a set schedule, which eliminates many of the problems mentioned.

Bright lights in the nighttime work environment significantly increase performance. But, it's impossible to use bright lights when dark adaptation and night vision are critical to Coast Guard missions.



Changing wake-up times, even as little as two hours, disrupts the energy-restorative process and degrades alertness and performance.

Remedies

Bright lights in the nighttime work environment significantly increase performance. But, it's impossible to use bright lights when dark adaptation and night vision are critical to Coast Guard missions. However, pilots and crew should try to gain exposure to bright lights before each sortie. This exposure, even for a relatively short time, will help to reset the body clock, and prepare the body for wakefulness during the "back side of the clock." Planning the crew's exposure to sunlight is a powerful tool.

Conclusion

If you are tasked to schedule an RCO deployment, pay particular attention to sortie times and length. If possible, schedule an RCO crew dedicated solely to the special op mission.

Can a crew adapt completely to the "night shift"? I don't have a good answer. Full adaptation is hindered by lack of bright lights in the nighttime workplace during an operational patrol. However, recent studies have shown progress in phase shifts when temporary bright-light exposure is scheduled during the night shift.

What can be done in advance and during the deployment to ease the transition to the "night shift"? Strict maintenance of sleep, diet and environment is the cornerstone. The entire crew-endurance team, including schedulers and crew members, must adhere to the guidance I've presented. Obviously, operational commanders will be constrained by a variety of factors that may render some of this guidance unachievable. The goal is to provide safe, well-rested crews for night missions on a recurring basis and enhance the opportunity for success.

LCdr. Staier flies the HU-25 Falcon Jet, and is stationed at Coast Guard Air Station Cape Cod, Mass.

Mishap-Free Milestones

VFA-83	11 years	44,500 hours
HS-8	24 years	
HS-14	9 years	31,000 hours
VRC-40	21 years	95,099 hours
VAW-124	12 years	23,000 hours
VR-53	11 years	43,425 hours
VP-40	38 years	243,000 hours
VAQ-138	23 years	38,584 hours
VF-11	11 years	37,881.5 hours
HS-6	16 years	53,500 hours
HC-5	7 years	52,052 hours
VAQ-129	2 years	15,137 hours
VFA-81	11 years	45,500 hours

HT-18 27 years 1,000,000 hours

Congratulations to Helicopter Training Squadron Eighteen on this historic milestone. Based aboard NAS Whiting Field, Milton, Fla., HT-18 trains approximately 300 new helicopter pilots annually in the Bell TH-57 Jet Ranger.

HT-18 celebrates the squadron's surpassing 1,000,000 Class-A mishap-free flight hours at a cake cutting ceremony. From left, 1stLt. Justin Howe and Maj. Keith Kincannon, the crewmembers who flew the TH-57 aircraft that reached the milestone; HT-18 Commanding Officer LtCol. Ron Colyer; Suzanne Carris, aircraft issuer, TH-57 Program and David Carrington, maintenance manager, TH-57 Program. Photo by Kevin Gaddie