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NIGHT FIT | WORK HARD SLEEP HARD

TRANSOCEAN

Proactive fatigue countermeasures at Leader

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INTRODUCTION

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Improved resilience against fatigue

A constant focus at Transocean is to create an incident-free workplace for everyone at all times. In order to assess the risk of shift work fatigue and to pro-actively bolster its defences against it, Transocean implemented Night Fit on their semi-submersible drilling rig Leader.

During the project 82 shift workers were taught to make use of the Night Fit strategies. Blue light blocking sleep glasses were applied which reduce the negative effects of light on the biological clock when worn prior to sleep. The preliminary findings as documented in this report show that the implemented strategies have helped the crew to sleep more effectively during off-shift rest. This increases their resilience to fatigue risks while also improving their performance and mental and physical health.

Every three years working offshore, the crew spends almost a full year asleep. This critical phase of shut-eye has a direct impact on brain performance, alertness, and other safety-critical functions such as memory, situational awareness, and the ability to think critically.

Work Hard, Sleep Hard: Leader

In total 82 shift workers were trained and guided in using the Night Fit strategies during two interactive workshops called 'Work Hard, Sleep Hard'. Special glasses and energy lights were used which, when applied correctly, have a positive effect on the secretion of sleep hormones and energy levels of the crew. Furthermore, they support effective off-shift recovery and adaptation to work shifts – and all that without the need for medication.

THE CHALLENGE

Optimal performance requires optimal recovery

Shift work and long working hours are inevitable components to maintain 24/7 production at the rig. The high working pressure combined with the need to remain fully concentrated and alert requires the crew to recover optimally between shifts. Just a like a battery needs to be recharged, the crew also needs to charge their energy levels.

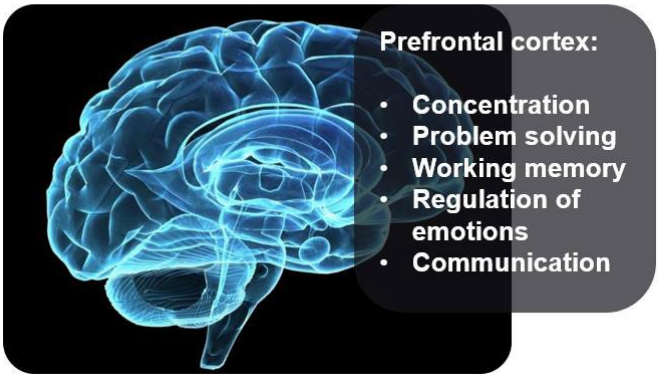
Most of the restorative functions in the body of the crew occur during sleep. High quality sleep is essential for the crew to ensure optimal physical and mental recovery, and to perform their tasks at a safely manner.

Many of the major restorative functions in the body and brain occur mostly and, in many cases, only during sleep. Examples of these restorative functions are amongst others tissue repair, muscle growth, growth hormone release, and the cleansing of the brain. High quality sleep is essential for the crew to ensure optimal physical as well as mental recovery and to perform their tasks at a safely manner.

Safety starts in the brain

High quality sleep is crucial for our brains to perform optimally. After a good night of sleep, your brains are cleaned from toxins and fully supplied with energy in the form of glucose and glycogen. As a result, your neurons (brain cells) are able to function more effectively which leads to increased alertness, energy, concentration, and problem-solving abilities.

The prefrontal cortex of our brain is **highly sensitive** to sleep restriction.



"Process safety" section of the brain

60-70% higher risk of injuries and accidents*

This is supported by neuroscientific research and studies from the military and aviation which clearly show that long shifts can be dangerous, and that high-quality rest is essential for optimal brain performance (Alhola et al., (2007). When the crew sleeps better, they have more energy, they are more focused, and their work and safety performance is better.

A fatigued brain is a hazard for process safety. Sleep enhancement is the most effective way to reduce fatigue levels at the work floor.

> **"A workforce which has slept well consistently will perform more efficiently and safely. There are less chances of making mistakes and workers hurting themselves or potentially others."**
>
> ***- Roderick – HSE safety advisor Leader***

> **"Better sleep leads to a happier, more focused, motivated as well as alert work force and this is better for productivity and safety."**
>
> ***- Ryan – Toolpusher***

Alhola et al., (2007). Sleep deprivation: Impact on cognitive performance. Neuropsychiatric disease and treatment, 3(5), 553.

High economic and safety losses due to fatigue – some numbers:

- Excessively sleepy or fatigued workers are over two-thirds (60 - 70%) more likely to be involved in accidents than well-rested and alert individuals. (Swaen, et al., 2003)
- Workers with sleep problems have a 62% higher risk of being injured at work.
- Approximately 13% of all work-related injuries can be attributed to sleep problems (Uehli et al., 2014).
- The HSE (Health and Safety Executive) has described fatigue as a major safety hazard.
- A lack of sleep amongst workers in the USA costs approximately $ 411 billion and losing 1.2 million working days per year (Hafner et al., 2016).

The danger of fatigue – a recent case example (2019)

A near-miss incident at Aberdeen Airport that happened last year involving an Airbus 175 offshore helicopter was caused by fatigue of over-worked ground engineering staff, according to the Air Accidents Investigation Board (AAIB).

The Air Accident Investigation Branch (AAIB) found a maintenance task, carried out 50 hours beforehand, had not been correctly completed, with a key component not being replaced. It found that the engineer supervising the task had only two days' rest over a 31-day period which had "not been identified by shift managers". A report into the incident also found the engineer was supervising a ream of non-type related engineers who had never completed the task before. Investigators said both of these factors could have contributed to the failure of the engineering team to replace the component. Operator CHC said it welcomes the report and that it took a number of measures to reinforce procedures immediately after the incident, which included revision of shift monitoring and fatigue prevention.

Source: https://www.energyvoice.com/oilandgas/north-sea/203548/union-to-push-for-helicopter-inquiry-in-wake-of-disturbing-report/

Swaen et al., (2003). Fatigue as a risk factor for being injured in an occupational accident: results from the Maastricht Cohort Study. Occupational and environmental medicine, 60(suppl 1), i88-i92.

Uehli et al., (2014). Sleep problems and work injuries: A systematic review and meta-analysis. Sleep medicine reviews, 18(1), 61-73.

Hafner, et al., (2016). Why sleep matters — the economic costs of insufficient sleep: A cross-country comparative analysis. Santa Monica, CA: RAND Corporation, 2016.

Fatigue affects us all

Although there are individual differences in how fatigue affects alertness and performance, nobody is immune from its effects. A highly fatigued shift worker will be less alert, less able to mentally process information, will have slower reaction times, and less work situation awareness. Combined, these factors lower productivity and increase the risk of work-related errors and accidents. Managing poor sleep and fatigue is therefore a top priority for O&G organizations in order to maintain a safe and productive working environment.

There is an established link between fatigue and reduced cognitive functions such as slower reactions, ability to process information, memory lapses, absent-minded slips and lack of attention. This can result in adverse consequences such as accidents and injuries as well as having an impact on health (HSE.UK, 2018 offshore information sheet)

Night Fit: Feedback from the crew

> **" Found myself going to sleep a lot sooner, so getting longer sleeps. With better sleep people are more aware when they are on the job, making it safe for them and others around them."**
>
> ***- Paul - Steward***

> **" The time it takes from lights out to falling asleep appears to be a lot less. It boils down to awareness and alertness in whatever task you are doing. Work is always made more difficult when you are fatigued.t"**
>
> ***- Richard - ROV Supervisor***

BIOLOGICAL CLOCK AND SAFETY

How our internal biological clock affects performance and safety

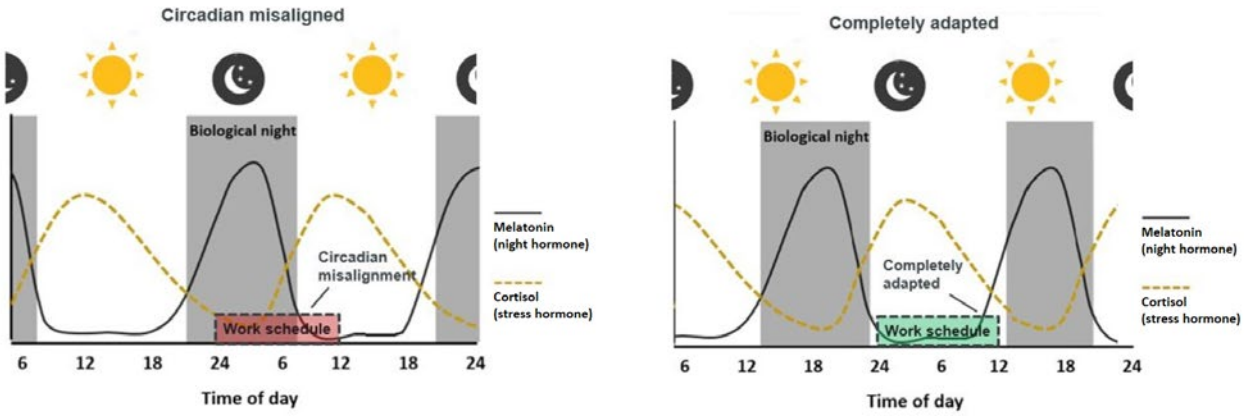
The modern offshore oil and gas industry demands a continuous 24/7 production. However, human beings are not built to work during the night. Naturally, our body is programmed to ensure that energy, alertness, concentration, and other aspects relating to mental and physical performance peak during the day. This programming is done in our internal biological clock cantered in our brain. Receptors in our eyes send information to this internal clock about the colour and intensity of light, which keeps it attuned to the natural alteration of light and darkness.

Blue morning light is the natural sign for our body's clock that the day has started. As a response our brain signals our body to remain active. During night-time, the lack of blue day light normally promotes our brain to secrete melatonin. Melatonin is a highly effective antioxidant and protects our cells and DNA from free radicals and oxidative stress (WHO). This hormone affects mental and physical rest and recovery, it thus helps to promote an optimal quality of sleep. Although our body produces melatonin naturally, blue light during and prior to normal sleeping times hinders its natural production because it postpones the release of the night hormone melatonin. Blue light blocking glasses were used in this project to enable a more natural production of melatonin and to promote a more natural sleep.

Circadian misalignment

At a normal sleep-wake cycle, our internal biological clock makes us feel sleepy in the late evening and ensures that we can maintain restorative sleep during the night. When flying across multiple time zones to an offshore location or during the abrupt transition to a night working schedule, the sleep and wake timings of our biorhythm become misaligned with the imposed working schedule.

This phenomenon is called 'circadian misalignment', a mismatch between our internal circadian clock and work, sleep and eating activities (Scheer et al., 2009). It's similar to the experience of a jetlag. Such 'circadian misaligned' shift workers have to work when their body prepares to sleep and have to go to bed when their body tells them to stay active.



This figure illustrates the different transition stages of the circadian rhythm adapting to a specific shift work schedule. At the first nightshift (left image) the crew has to work during parts of their biological night and has to go to bed when their body tells them to remain active. This, in turn, decreases both the quantity and quality of sleep and reduces performance and safety. As shown in the right image some shift workers manage to completely adapt to the night work schedule. In these situations, their biological night switches to the day. Blocking blue light prior to their daytime sleep helps to reduce circadian misalignment. The timed blocking of blue light helps the crew to adjust to the new work-sleep schedule more quickly and more completely (Appleman et al, 2013). Meijer et al., SPE 187048-MS, 2018)

> **"The first few days when I'm changing to night shifts, I'm fatigued. Also during the first few days changing back into a normal daily routine and the very last shift changing back into night shifts."**
>
> ***Anonymous – Floorhand***

> **"Short change 8 hours off shift, takes me a few hours to fall asleep. Only getting Approx. 2–3 hours' sleep on short change."**
>
> ***Anonymous – Derrickman***

Source: Scheer et al., (2009). Adverse metabolic and cardiovascular consequences of circadian misalignment," Proceedings of the National Academy of Sciences of the United States of America, 106, 4453–4458

Meijer, Robb & Smit, 2017: SPE-187048-MS Shift Work Fatigue in the Petroleum Industry: A Proactive Fatigue Countermeasure

Sleep in shift work environments

The inability to sleep is the second most common health complaint internationally and is a common problem in offshore shift work environments. During offshore night shifts, daylight exposure is inconsistent with the work shift. For some shift workers this hinders optimal adaptation to the new offshore work schedule. Circadian mis-alignment (i.e. the state in which a person is not fully adapted to the shift schedule) combined with the noisy and stressful work environment result in sleeping problems which are a serious issue in the offshore industry.

Fatigue is a common in the offshore-industry – a study in the journal Industrial Health

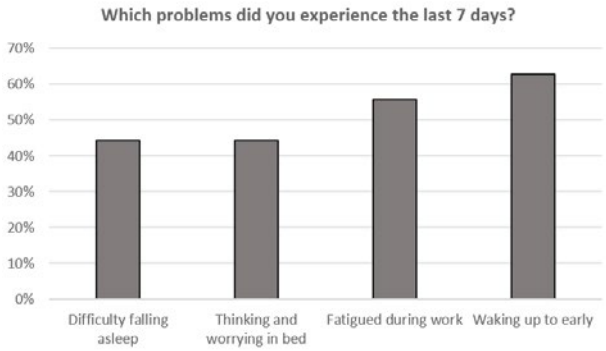
"The study indicates that it isn't only the shift system itself, but rather long working days over a two-week period in the North Sea that affect sleep," says Siri Waage. During a typical 14-day work period in the North Sea, the workers will work twelve hours a day whether doing night or day shift. "Although offshore work influences the sleep pattern, there were no differences in subjective health complaints between the groups at the end of a work period than at the beginning," she says.

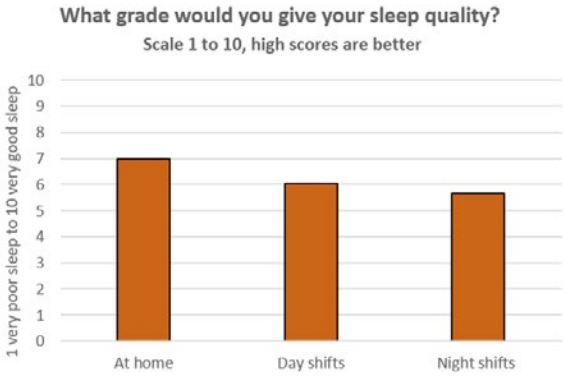
Around 200 roughnecks participated in Waage's study, which was recently published in the journal Industrial Health. Even though there were minor variations between the groups, both groups of workers experienced poorer sleep quality and more complaints of insomnia at the end of a two-week work period offshore than they did at the beginning of the work period.

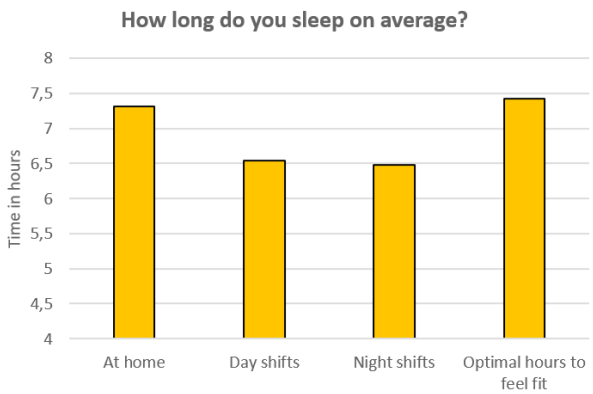
Source: Waage, S., Moen, B. E., Pallesen, S., Eriksen, H. R., Ursin, H., Åkerstedt, T., & Bjorvatn, B. (2009). Shift work disorder among oil rig workers in the North Sea. Sleep, 32(4), 558-565.

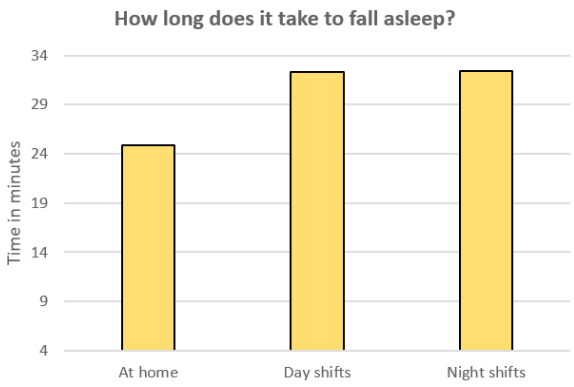
SITUATION PRIOR TO NIGHT FIT

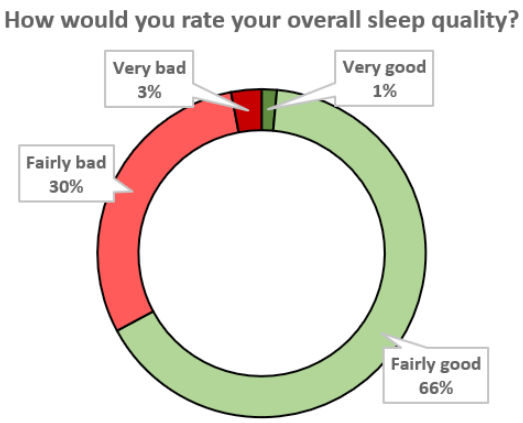
A sleep quality questionnaire was presented to the crew active at the Leader in September 2019. In total 72 shift workers participated in this baseline assessment.

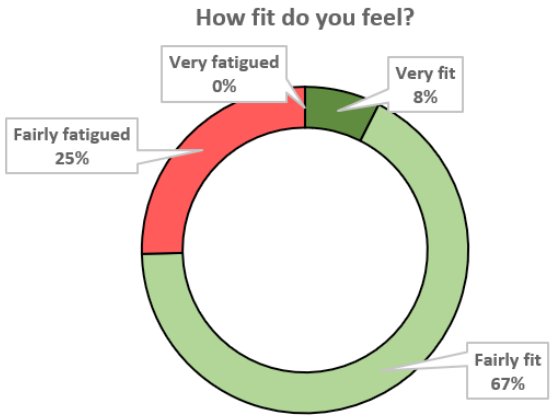












The potential to enhance sleep quality in offshore environments

Overall, the participants reported to sleep better at home than during offshore day shift operations. The quality of sleep during offshore night shifts scored the lowest. These findings indicate that there is still much potential to improve the shift worker's quality of sleep in offshore environments. The Night Fit method is created to do just that.

NIGHT FIT

What is Night Fit?

The Night Fit strategies were taught to the offshore crew using two interactive workshops called 'Work Hard, Sleep Hard'. Night Fit uses effective light treatment strategies to ensure a quicker and more optimal fit between the crew's biological clock and the new work/sleep schedule. It is a complete program that offers the crucial tools and guidance for successful long-term results.

> **"Never had this type of workshop before to comment on expectation but definitely got good input to how the brain and mind is operating and how to improve sleep. Especially when Working night shift all the time it is very important to come into the workplace fully charged and the mind at full working condition. This for a proactive and safe mindset for the task and job at hand."**
>
> ***Anonymous Assistant Barge Supervisor***

> **"Good workshops. Helped to understand how sleep affects you and what you can do to encourage the body to sleep better. Shows that the company is interested in workers' health and the effects of nightshift and anything that can help the transition into and out of night shift is appreciated as so much time energy is lost to feeling tired and lethargic when transitioning from day/nights."**
>
> ***David Subsea div***

The dark side of blue light

Blue light is the primary signal to our bodies that indicates whether it is time for action or for rest. In this project blue light blocking glasses were used to synchronize the blue light signals received by workers with their sleep-wake cycle. Several studies demonstrate that by blocking blue light during and prior to the scheduled sleeping times, the production of melatonin (an important sleep hormone and anti-oxidant) is stimulated. It should be noted that we advise against shift workers wearing the glasses during work, as this can cause drowsiness and loss of vigilance and alertness.

Visit the website **www.km-humanfactors.com** for all scientific references regarding sleep, blue light and the biological clock.

> **"I'm not sure if it's a placebo effect or something but while wearing them my eyes felt heavier and I felt more sleepy. If it is possible to get better sleep patterns and all-round wellness, that's always a good idea."**
>
> ***Anonymous - Steward***

> **"Just start switching off as soon as I put the glasses on, makes me feel chilled out and wanting go to sleep after around 15/20 minutes. Feel more relaxed with glasses on, once I got into a routine with glasses it was if as soon as I put them on my brain was telling me to go to sleep"**
>
> ***Anonymous - Assistant Driller***

> **"Only just back on the rig after doing night fit sessions last trip, used them after night fit sessions and they did help, although I didn't have a big problem getting off to sleep before I think they have helped me sleep better/deeper."**
>
> ***David - Subsea div***

> **"I wear the glasses around 1 hour before going to sleep and it definitely gave me more of a sleep mindset and feeling ready to get to sleep."**
>
> ***Anonymous - Assistant Barge Supervisor***

Importance of (day)light

The intensity of artificial lights onboard the rig is too low to be sufficient to provide the strong 'morning' light cue needed for night shift workers to efficiently reset their biological clock.

Light intensity in different conditions

Illuminance (lux)	Surfaces illuminated by
0.05–0.3	Full moon on a clear night
80	Office building hallway/toilet lighting
200–450	**Offshore lighting**
200–450	Office lighting
2.000-3.000	Cloudy day
10.000–25.000	Full daylight (not direct sun)
32.000–100.000	Direct sunlight

As a result, some shift workers find it hard to fully energize themselves during their work. On the other hand, the lack of real darkness prior to sleep disrupts an optimal preparation for sleep. These non-optimal light cues, which are tackled by the Night Fit method, contribute to poorer overall quality of sleep, alertness and energy. Night Fit uses bright blue lights and special glasses to synchronize the light cues with the shift work schedule. When applied correctly, this will lead to a quicker and more complete adaption to the work schedule, resulting in improved sleep efficiency and reduced fatigue related problems.

> **"I felt more relaxed when going to bed. I have even taken them home with me to use in the house. My wife thinks I look daft but damn I am getting a good sleep!"**
>
> ***Jonathan - Cementer***

> **"I Feel that I sleep more deeply. And if I do wake up early, I put the glasses on and read for a short period and find I can get back to sleep. Whereas this was never the case before using them."**
>
> ***Ryan - Toolpusher***

'WORK HARD, SLEEP HARD' WORKSHOPS

The project involved supporting crew members with two workshops on how to apply effective sleep hygiene strategies and how to use the light treatment methods during offshore shift work operations.

During the workshops the following questions were answered: How do sleep, fatigue, blue light, and the biological clock affect your physical and mental performance? What are the effects of improved quality of sleep on growth hormone release, immune system, and brain performance? How can you fall into a deep sleep more quickly and how can you realize a better alignment between your circadian rhythm and your working schedules? These and many more questions were answered during the workshop. Those workers reporting severe sleep problems were provided with one-on-one personalized advice in order to address their problems individually. Positive feedback from the crew:

> **"Found workshop interesting and of good use to myself and others in the industry as working nights and regularly changing shift patterns. As being a regular thing sleep can be easily broking during these times. The workshop was well presented with good interaction."**
>
> ***– Mark Asst Derickman***

> **"Fantastic workshop which was very informative and educational, taking away lots of learnings about how I can better prepare and equip myself to cope with the demands of night shift. I will also look to change habits at home to get a more fulfilled sleep."**
>
> ***– Andrew driller***

> **"An important project that affects everyone working shift patterns especially in the oil and gas sector. Very well presented by someone who can relate to our situation. I've Definity picked up a few techniques to help me with my trouble areas regarding sleep, especially short change."**
>
> ***– Jack Floorhand***

Reducing workforce stress levels:

Short relaxation and meditation exercises, ranging from 5 to 10 minutes a day, were provided in order to reduce stress. Military studies have shown that these exercises relieve stress, increase sleep quality, and result in better overall performance. 55% of the participants applied for these exercises.

"I found them very helpful to de-stress and get a feeling of calm."

"Excellent, tried something similar before but did not adhere to it"

"Helped me switch off."

"Felt calm and relaxed mind."

"I already use meditation so I knew what to expect, felt relaxed."

"This goes hand in hand with the glasses to help relaxation and a successful sleep."