



fatigue

Everyone, at some time or other, gets fatigued. Statistics on the impact of fatigue abound within the transport industry, from trucks to trains to ships, and, worldwide, aviation is no exception. The aviation industry is continually developing safeguards against fatigue. The Civil Aviation Rules limit duty periods and provide roster guidelines; airlines and other aviation businesses educate staff to identify the symptoms, and take part in clinical research to help develop strategies.

All fatigue studies show huge extremes of sensitivity to tiredness and work-period lengths among individuals, indicating that the goal cannot be to develop a perfect law that prevents fatigue in everybody.

Instead, the most effective weapons against fatigue are the decisions of each aviation businessperson, pilot, engineer and air traffic controller.

Eighty-six percent of New Zealand anaesthetists report making a fatigue-related error at some time in their careers; the US National Transport Board implicates driver fatigue in 30 to 40 percent of all heavy trucking accidents; at least 70 percent of Swedish locomotive engineers report having dozed off while on night trips; the Japanese Maritime Research Institute says that lack of alertness and dozing during navigation account for 53 percent of ship groundings; and in the United States, fatigue is considered a contributing factor in 20 percent of confidentially reported accidents and incidents across all sectors.

"Almost everyone has felt fatigued at some stage in their lives, but not everyone then tries to fly 200 passengers into Wellington in a screaming southerly..."

So why would New Zealand aviation be any different?

Yet according to the CAA's accident database, it is. The statistics show that fatigue accounts for just 0.2 percent of all accident and incident causes (a given accident or incident may have multiple causes).

But it's not very likely that these figures are reflecting reality. CAA Manager Safety Analysis, Peter Nalder, says he would expect the real figure to be more like 25 percent.

"From what we know of other countries, we are reasonably sure that fatigue is chronically under-identified," he said.

Manager Safety Investigation, Richard White, agrees.

"One of the key drawbacks is that our safety system relies on voluntary accident and incident reports from pilots, controllers and engineers, so unless reporters recognise that fatigue may have been a factor, we may miss it too.



"It's also not typical of our culture to say 'Well, I was so tired, and I just slipped up'. It's far more likely that people will look outside themselves for an external reason why something has gone wrong.

"And fatigue is a hard thing to quantify. At what point do you attribute normal forgetfulness or lack of concentration to fatigue? We've all been driving a familiar route and suddenly broken out of deep thought and realised we can't remember the last few minutes of the drive. In aviation, that can be all it takes," he said.

"Almost everyone has felt fatigued at some stage in their lives, but not everyone then tries to fly 200 passengers into Wellington in a screaming southerly, or hover a helicopter just a few feet above power lines for hours.

"As Safety Investigators, we need to get better at asking the questions that will expose any fatigue issues that may have played a part," Richard said.

Aviation doctor Tony Hochberg teaches the dangers of fatigue to regional airline pilots.

"The impairment with fatigue can be just as bad as that you get with alcohol. Flying fatigued may be just as dangerous as being a drunk driver," he said. "Recognising the fatigue can be a problem."

"It also impacts on your health. Shiftworkers who regularly do a graveyard shift, from midnight to 7 am, have about double the risk of heart attack and stroke, but it's not clear why that is."

Why do shiftworkers suffer fatigue?

Under the Directorship of Associate Professor Philippa Gander, at the Sleep/Wake Research Centre, Wellington School of Medicine, research on fatigue in the workplace is under way. Doctoral research by Leigh Signal, in partnership with Airways New Zealand, is centred on air traffic controllers and the impact of scheduled napping during night shifts, while Michelle Millar is examining fatigue among doctors. They hope their work will lead to a better understanding of

fatigue in New Zealand's workplaces and provide strategies for shiftworkers.

"Shiftworkers are far more at risk of fatigue than day workers. Humans are designed to be awake during the day and asleep at night. Our body clock finds it difficult to change to a new pattern of work and sleep, so when working a night shift, the shiftworker will be sleepier and perform more poorly," Michelle said.

"The reason your body clock can't change quickly to working nights is that your body gets a lot of cues from the environment about what time of day it is. Daylight is a very strong cue that keeps telling your body clock that you should be awake.

"The big problem for any shiftworker is getting enough sleep. If you are working during the night and sleeping during the day it is very hard to get enough good quality sleep. Long hours of work can also add to this problem by limiting the amount of time available for sleep. Night workers tend to get one to two hours less sleep per day than day workers. Over several days, they will build up a sleep debt, like a bank account – but it's not possible to get a credit. You can only get back to a zero base line by having two full nights of sleep."

Another current study of napping as a weapon against fatigue is being carried out by University of Otago doctoral fellow, Melissa Purnell, and Associate Professor Anne-Marie Feyer. Like Leigh and Michelle, their investigation is breaking new ground by measuring the effects of napping not in a laboratory, but in the workplace under normal operating conditions.

A group of aircraft maintenance engineers were given the opportunity to take a 20-minute nap during their 12-hour night shifts. The engineers' performance on a range of tests, designed to be sensitive to fatigue, was measured at the start and end of each shift containing the nap, and was compared to their performance on night shifts without naps. The results showed that the engineers performed significantly better at the end of the night shifts with the nap compared to without.

"The results of our work so far clearly indicate that strategies aimed directly at alleviating fatigue show considerable promise. However the challenge remains





“You do lose your sense of humour. You get edgy and you don’t want to be crossed. I wouldn’t want to live with myself when I get like that. You can also get short-term memory loss. You’ll be working fine for about an hour, and then you’ll suddenly look up and think ‘I did what?’

“I was flying to Dunedin one night on the late shift, and just after touchdown I looked over at the copilot and said ‘shall we do the landing checks now?’ We were both just doing things automatically, but didn’t physically go through the checklist. I obviously should have said I was fatigued and not flown that day,” the pilot said.

Licensed Aircraft Maintenance Engineer Jim Frazer has been instrumental in developing a 12-hour shift roster that was given the support of 84 percent of hangar staff after a 12-month trial.

While he has never seen a major error occur due to fatigue, he says shift work is challenging, and newcomers have to be educated about the pitfalls. “If you’re a shiftworker, you’ve got to think ‘this is my life’. You’ve got to prepare for it and look after your body a bit better than a non-shiftworker. That means going to bed when it’s a beautiful sunny afternoon and you’ve got things to do. If you don’t change your life to fit with the night shift, the night shift will beat you.”

As acting shift supervisor, Jim is well aware of the importance of monitoring the performance of others.

“You can tell if someone’s more weary than usual, and you give them a job that matches their alertness level. It’s aircraft maintenance, so it’s got to be in hand.

“Not all maintenance jobs are glamorous or safety-related. Pulling insulation blankets out of a cargo hold requires a lot less concentration than rigging an aileron,” he said.

A shiftworker for the past 11 years, who co-authored her own roster and has taken part in studies to develop strategies for protecting against fatigue, said the shiftwork was beginning to tell.

“When I’m fatigued, it feels like I’ve just been sitting in economy class for 20 hours and I’ve been through six time zones. I generally feel tired and might be listless and grumpy at work,” she said.

in effectively integrating strategies such as napping into the workplace under operational conditions,” Melissa said.

Melissa and Anne-Marie expect to publish their results by March next year.

Who’s fatigued?

Fatigue is a tricky concept to predict because it is very individual. What exhausts one person will be a walk in the park for another. And the same person can react differently to the same situation from week to week.

The New Zealand Engineering, Printing and Manufacturing Union says fatigue is “a temporary inability or decrease in ability to respond to a situation, because of previous overactivity.” It says this is hazardous when lives and well-being are at risk.

A pilot who has logged more night hours than day hours over the past six years says that as fatigue builds up, it starts affecting more and more of your life.

“To say that flying at night was 100 percent efficient would be a lie. If we had to use lateral thinking to get ourselves out of the cactus, we’d be in trouble.

“But if you’re suffering from fatigue, you’re the last one to know. You end up in the hereafter – you don’t know what you’re here after for. You might walk into a shop and people think you’re nuts. You just stand there and wonder what you came in for.

Surviving shift work – hints from the experts

Sleep is the most effective weapon against fatigue. Often shiftworkers think they can motivate themselves to adjust to working at night and sleeping during the day, but the body doesn't respond to motivation.

Michelle Millar says sleep research shows most people adjust very slowly to changing schedules, and they may need about a day for every hour that their schedule is altered, while others may never adjust to working at night.

"Shiftworkers also tend to revert back to a normal cycle on their days off, so their body is continually trying to keep up. This constant changing leads to feeling cranky, tired and unwell – just like perpetual jetlag," she said.

Leigh Signal adds, "A shiftworker may be better off fitting in sleep that coincides with their body's natural cycle."

Known as the body's circadian rhythm, this cycle of highs and lows throughout the day is common to all people, and to all of the body's systems.

"It is hardest to stay awake between 3 and 5 am when all of the body's functions are at their lowest ebb. Another good time for getting to sleep is in the early afternoon. But the body is most alert at 10 or 11 am, and again just before bedtime.

"You can use the body's natural rhythm to help your sleep. Shiftworkers who work until 6 am should try and get to sleep as soon as possible after the shift, before their

body alarm goes off and wants to be alert at 10 or 11 am," Leigh said.

Time your naps

If you want to be able to perform well immediately after a sleep, you can minimise waking up feeling groggy by controlling the length of your sleep.

Sleep is the most effective weapon against fatigue

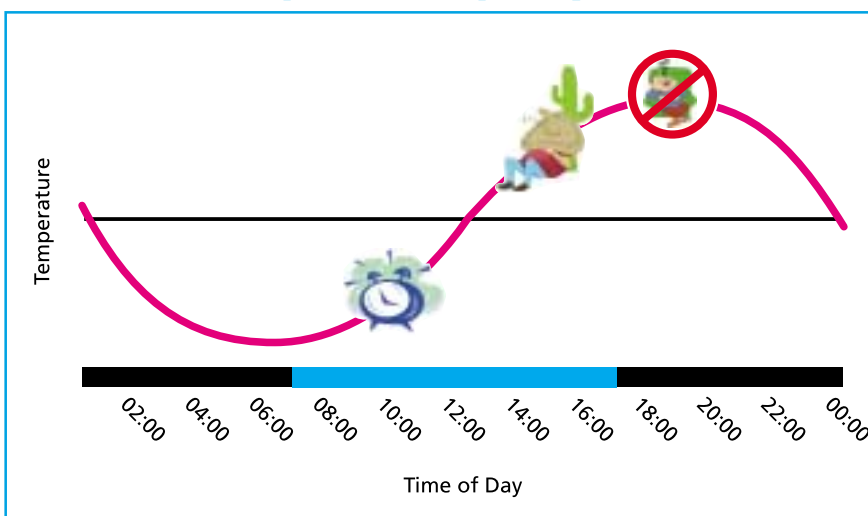
Being woken during deep sleep worsens the effects of sleep inertia. After you fall asleep, for the first hour or so, you go progressively deeper into sleep. Limiting a sleep to around 40 minutes ensures you wake before entering deep sleep. Alternatively, continue to sleep through to 90 minutes, or multiples of 90, when you are less likely to be in the deeper stages of sleep. However, some sleep is always better than none.

Take precautions

- Darkness is a key trigger to your body that it is time to sleep. Black out curtains, or tin foil over windows and an eye mask will help give your body the message.
- Switching the answer phone on, turning the ring off, and explaining your timetable to friends and family will help limit interruptions.

- Eat properly. Stomach complaints are common among shiftworkers who often eat large meals during the night when digestion is less efficient. Eat light, healthy meals during your shift, and do not have a large meal immediately before sleep.
- Regular exercise will improve your overall health and your ability to relax, but a workout just before bedtime will probably interfere with your plans for sleep.
- Follow a regular pre-sleep routine to trigger your body that it is time for sleep. This could be as simple as reading in a chair for a few minutes, putting on your pyjamas and brushing your teeth.
- Don't use your bedroom for doing your tax return or studying for your exams.
- Mental relaxation techniques can help you relax and fall asleep. There are hundreds of books and tapes available on these techniques.
- Avoid alcohol, caffeine and nicotine in the hours before bed. Caffeine and nicotine are stimulants and will keep you awake. Alcohol will help you fall asleep, but will affect the pattern of your sleep. The result can be disturbed sleep later in the sleep period caused by 'the sweats', and vivid dreams or nightmares.

The Circadian Rhythm of Body Temperature



How much is enough?

There is enormous individual variability in how much sleep people require. The average person reports getting 7½ to 8 hours per night. This is what they report getting, rather than what they necessarily need. So, the amount of sleep an individual needs is the amount that person requires to feel fully rested. There is no evidence that you can get too much sleep, but it is important to realise that you can't store sleep up as a credit for a later date.

Give yourself the once-over

1. Have you had less than two full nights of sleep in the last two days?
2. Has it been more than 12 hours since you last slept?
3. Are you going to be working during the night?

If you've had 10 hours sleep in the last two days, it's been over 12 hours since your last sleep, and you'll be working at night, you're putting yourself at risk – Leigh Signal and Michelle Millar, sleep researchers.

Staying alert through the long hauls

There are things you can do to stay alert, but these will only work for a limited time. As sleep is not optional, in the end you will sleep no matter where you are or what you are doing.

- If you are tired, you can limit the effects to some degree by stretching or walking around if possible, and by talking to other people.

The pilot spoken to here says two-pilot crews can definitely help on the night shift.

"We share the load around, and talk. Some guys are not conversationalists, but even a few grunts help to keep the other guy alert. After a while, you do lose your ability to concentrate. We try and challenge ourselves by doing things like an NDB approach, or having a look at a flapless landing." (To break the monotony, do things that are different rather than difficult.)

- Caffeine can give you a short-term boost, but not if you use it continually. Save that coffee for the hard times. If you are feeling alert before a shift, have a caffeine-free drink instead. Coffee is a diuretic though, so think about when you take it, and avoid it in the few hours before sleep.

- Consider your personal comfort. You will tire more quickly if you are cold as your body is using energy to keep warm.

There's no such thing as a perfect roster mate

Designing a roster can be a thankless task. Leigh Signal and Michelle Millar point out that no roster is ever going to suit all staff, and meet management requirements.

"There will never be a perfect roster because everyone is an individual. Some people will be fine on a roster, and others will struggle with it. But there are some ways of improving your chances of getting it right," they said.

- Learn about typical body-clock rhythms. If someone finishes work at 9 am, they will find it very hard to sleep when they get home. They would be better off finishing work at 6 am. But the person who then starts at 6 am will also be affected as their sleep is restricted by the earlier start.
- Involve the people being rostered. Ask for their input even though their wishes may be difficult to achieve.
- When you are programming in time off, think about time for sleep, travelling home, eating and spending time with the family. On minimum turn-arounds, there is more to consider than just sleeping time.
- A forward-rotating shift in which shifts start progressively later each day is easier for the body to cope with than a backward-rotating one. Staff may prefer a backward-rotating shift because it compresses the working week, leaving more personal time, but be aware that this type of shift is more difficult for the body.

If you are a shiftworker and you are finding it tough, you are not going crazy. What you are doing is harder than normal day work. Follow the suggestions above, and if you have any safety concerns, contact the CAA on 0508 4 SAFETY (0508 472 338).

Comments from fatigue-related New Zealand incidents

- The pilot was fatigued from a long day previously and an early start the next day.
- The shiftworker showed a lack of concentration probably brought about by an unusually long shift and coinciding hangover period.
- Cause not determined but shiftworker believed that as it was the last hour of the last shift in the roster cycle, fatigue could have been a factor.
- The officer forgot to carry out the addressing requirement in its entirety.
- Procedure not followed as engineer was distracted.
- The pilot did not check NOTAMs before the flight
- Short-term memory loss
- Fuel starvation
- Distracted
- Lack of attention to clearance