



JAMES OSTINGA

### Dr David Newman

**W**E ALL KNOW THAT AN INTOXICATED pilot presents a serious hazard to flight safety. In the US, approximately 16 per cent of general aviation accidents are alcohol-associated, a rate which has been relatively constant since the 1970s. But that's just part of the story.

These statistics only account for those accidents where a pilot has had a blood alcohol concentration above zero. How many other accidents have been caused by alcohol's less-publicised after effects like fatigue, nausea and headache?

While the consequences of excessive alcohol intake on performance are well known, most people are less aware that their performance can be impaired long after their blood alcohol concentration returns to zero. For that matter even low or moderate amounts of alcohol the night before can seriously jeopardise the safety of a flight the following morning.

**Fatigue:** Alcohol is a widely used and readily available aid to sleep. The problem with alcohol is that it interferes with

normal sleep patterns. This results in poor-quality sleep, even though the total hours of sleep may be in the normal range. The reason for this is that alcohol promotes early deep sleep and suppresses early REM (rapid eye movement) sleep, the phase in which dreaming occurs. This can occur with quite small doses of alcohol, that is, with blood alcohol concentrations as low as 0.025 per cent. Larger doses may suppress REM sleep altogether. The change in sleep patterns or the deprivation of REM sleep causes subjective feelings of tiredness and impaired concentration the next day.

The news is not all bad however. Because the body will metabolise alcohol at the average rate of one standard drink per hour, alcohol can be safely consumed with an evening meal for example, providing enough time is allowed for your blood alcohol concentration to drop. The best target is to have a blood alcohol concentration of 0.0 per cent before lights out!

This point is worth emphasising – a nightcap just before retiring to bed may make you feel more fatigued and less alert the next morning.

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Alcohol also has a number of other effects on sleep. It causes early morning waking, and the diuretic effect may also promote a number of awakenings during the night as the requirement to empty one's bladder at frequent intervals becomes paramount. Alcohol will also accentuate the effects of jet lag. A few drinks after a trans-meridian flight across several time zones will certainly not help recovery from jet lag,

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and may in fact make the situation worse by degrading the quality of any sleep that the pilot manages to get.

**Disorientation:** Orientation in flight depends on three basic mechanisms: – sight, balance (vestibular system), and “seat of the pants”. Even small amounts of alcohol can significantly impair all of these systems.

The impairment of the vestibular system by alcohol will be well known to anyone who has had a big night on the town and woken the next morning to find that even the slightest head movement results in dizziness and the room going into a high velocity spin. This is caused by alcohol entering the semi-circular canals, which are responsible for sensing angular movements of the head. The alcohol dilutes the fluid in the canals, reducing its density by a considerable degree, meaning that with any given head movement, the fluid will travel further and faster, resulting in exaggerated signals of head movement being sent to the brain. This phenomenon is extremely disorientating on the ground, but is much worse in the three-dimensional environment of flight.

The Coriolis phenomenon is a severe tumbling sensation brought on by moving the head out of the plane of rotation, simultaneously stimulating one set of semi-circular canals and deactivating another set. Even modest amounts of alcohol can induce this effect, with even the slightest head movement while flying causing significant tumbling feelings and disorientation. This is particularly dangerous in IFR flight which is made significantly more difficult by this phenomenon.

The effect of alcohol on the vestibular system can persist for up to several days after blood alcohol levels have returned to zero.

Nystagmus effects the visual system and is described as a series of involuntary oscillatory eye movements generated by stimulation of the semi-circular canals. Nystagmus can be caused by spin recoveries, and its symptoms are amplified, in severity and duration, if there is alcohol in the system. Pilots suffering from Nystagmus find it extremely difficult to focus on either the outside world or the instrument panel. The disorientating potential of such a situation is quite marked, and can lead to complete loss of

control of an aircraft. Nystagmus can be demonstrated up to 11 hours following the intake of a single dose of alcohol.

**Performance:** The hangover syndrome can last 24 to 48 hours (depending on the amount of alcohol consumed in the intervening period). Hangover includes symptoms such as headache, gastrointestinal disturbance, impaired mental ability and fatigue. It can seriously degrade a pilot’s performance, even if the blood alcohol level is zero. This is well illustrated by a study in which pilots flew a simulator profile 14 hours after achieving a blood alcohol level of 0.01 per cent. Their procedural error rate was 68 per cent.

The general feelings of ill-health during the hangover period also have a negative effect on the performance of the pilot. For example, the headache is at best a distraction, but can be severe enough to effectively incapacitate the pilot and limit his/her ability to safely control the aircraft.

**Other flight stresses:** Alcohol also interacts with other stresses of flight. It is a known risk factor for both hypoxia and decompression illness, and also interferes with the regulation of body temperature.

Of importance to aerobatic pilots is the fact that alcohol reduces tolerance to G. Some studies have shown that even a moderate level of alcohol will reduce the G tolerance of the pilot by approximately 0.5 G. Alcohol relaxes smooth muscle and as such allows the veins and arteries to dilate. When G is applied, a greater percentage of the pilot’s blood volume is driven to the lower body (and hence away from the head). This effect is made worse by the dehydrating effect of alcohol, which reduces blood volume. Less overall blood volume and a greater percentage of blood heading into the legs will reduce tolerance to positive G and increase the risk of G-LOC (G-induced loss of consciousness). Increased levels of G also tend to exaggerate the nystagmus induced by alcohol, a situation that can persist for some 48 hours.

Alcohol has a number of persistent effects that can negatively impact on flight safety. There are significant problems in flying during the hangover period, and, as shown above, even flying the morning after a few drinks the night before may not necessarily be the safest option. Adherence to a simple bottle to throttle rule does not guarantee maximum performance in the air.

As safety-conscious pilots we should only fly when we are mentally and physically fit. In some cases that may mean not flying the morning after the night before.

*Dr David G. Newman is chief instructor at the RAAF Institute of Aviation Medicine.*

## Test your alcohol IQ

Take this simple test to find out how much you really know about alcohol.

1 A 12-ounce beer, a 4-ounce glass of wine and a 1-ounce shot of whiskey all contain the same amount of alcohol.

TRUE  FALSE

2 A couple of drinks before bed improves sleep quality.

TRUE  FALSE

3 Women react differently to alcohol than men, and generally can expect greater impairment from the same quantity of alcohol.

TRUE  FALSE

4 Pilots change their drinking patterns when away on a duty.

TRUE  FALSE

5 Modest amounts of alcohol don’t affect your flying.

TRUE  FALSE

### Answers:

5 False. Even modest amounts of alcohol can impair your flying, through the Coriolis phenomenon and other medical effects (see main article text).

4 True. A NASA study found that short-haul pilots consumed three times more alcohol on trips than at home.

3 True. For a number of reasons, women are more susceptible than men to the harmful effects of alcohol. Body size, body composition and metabolism all play a part.

2 False. A drink may help you fall asleep faster, but suppresses the hours you spend in REM sleep, reducing overall sleep quality. This causes subjective feelings of tiredness and impaired concentration the next day.

1 True. You can get just as drunk by drinking beer or wine as you can by drinking distilled spirits.

*For more information about the effects of alcohol on human performance, go to [www.glness.com/ndhs/facts.htm](http://www.glness.com/ndhs/facts.htm).*