The Pilot's Hearing Ears

by
Richard A. Hansen, M.D. AME

Joe sat in my office, awaiting his pilot's exam. That 'medical' certificate was so important to him, for it meant freedom to fly his Citabria. He had passed the age for acrobatics, but still thrilled with the steep climbs and turns, hallmarks of a performance plane with an experienced pilot at the controls. I spoke softly, "Good morning, Joe. How are things going for you?"

He looked at me blankly, and just responded with a "How's that again?" I spoke louder, and communication was quickly established. It was obviously that Joe was losing his hearing, not unusual for a man of 70, but disconcerting nevertheless. For his hearing impairment had come on gradually, noticeable at first more to others than to Joe. There was no sign of concern, and he could hear well enough to pass his flight physical. But I began to wonder, is this possibly preventible?

Most pilots make considerable efforts in protecting their vision. We wear sunglasses when flying on bright days. We shade our eyes to protect them from glare. And we see our optometrist or an ophthalmologist regularly for prescription glasses and for eye exams. Clearly, vision is a precious gift. But so also is our hearing.

Hearing loss is often thought to be an inevitable result of aging. So we resign ourselves to saying "Huh?" or simply plan to turn up the volume or speak louder. However, two out of every ten adults ages 18 to 44 have a hearing impairment. In the age group from 45 to 64, the risk increases to three out of every ten. And, beyond age 65 four out of every ten people are hearing impaired. Though it is obviously a problem of aging, you can see that it is not only related to vintage. To more of an extent than we tend to admit, progressive deafness is a problem of exposure to damaging levels of noise. The longer one is exposed, the greater the risk, and the more likely a person is to experience hearing loss.

Age-related hearing loss is called presbycusis, and is the most common form of impairment. The reason it affects men more than women is related to the extent of an individual's lifetime exposure to noise. The second most common form of hearing loss, however is totally a result of unprotected exposure to noise. And that may occur at any age. Loud noise also affects the auditory nerves and damages the inner ear, an organ called the cochlea. Doctors call both kinds sensorineural hearing loss, distinguishing this condition from the temporary kinds of loss that follow a middle ear infection where fluid fills the middle ear, or an injury or trauma which can disrupt the intact ear drum. Brain tumors and infections such as shingles can also destroy hearing, but they are quite rare.

Clearly, noise is the main culprit when it comes to partial or progressive deafness. Noise is defined as any sound which may be judged too loud and unpleasant. Obviously, this judgment is quite subjective, but there are some physical parameters of sound which can be quantified. Every sound has three variables: frequency, duration, and intensity. The latter is a measure of pressure or loudness expressed in decibels (dB). Originally described by Alexander Graham Bell (the inventor of the telephone, whose wife was stone deaf), a decibel is equal approximately to the smallest difference of sound detectable by a normal human ear. The scale is logarithmic, meaning that every rise of ten decibels means that the sound is ten times louder in intensity. Whispered voices create sound at about 20 decibels, normal spoken conversation at 50 to 60

dB. A telephone or alarm clock rings at 80 decibels, while noise during cruise flight can reach 90 dB or more. A turboprop aircraft creates noise of about 110 dB at takeoff, while a jet engine at takeoff produces painful noise levels of 140 dB.

Unprotected noise levels of more than 90 dB can produce temporary hearing loss. One can be aware of the danger when the ears start to ring, and we find our selves talking louder or shouting to be heard. When the noise level reaches 120 dB, as in many rock concerts or at an air show, distinct discomfort causes us to plug our ears. What is happening is that the eardrum is vibrating at such an amplitude that the small ear bones, called ossicles, are producing a microscopic pressure wave, which I call a mini-tsunami, in the cochlea. The delicate hair-like sensors in this tiny organ create electric signals in the auditory nerves, and our brain interprets this as pain. That is now we protect our hearing, but too often the signals are ignored, and the hearing damaged.

Pilots are exposed to multiple sources of noise, such as cabin noises (fans, gyros, air conditioners, and various motors), power plant sounds (engine noise, propellers, rotors, hydraulics and electric motors), even occasionally the stall horn. Then, there are the radio communications, Morse code beeping sounds, static, and passenger conversations. Even a child or baby may cry to add to the cacophony of sound. When you add up all this sound, mostly distracting noise, it is clear why the pilot population is especially at risk of hearing damage.

Two protective techniques are available to pilots and passengers for reducing the levels of cockpit and cabin noise. These are called passive attenuation and active attenuation. The passive approach involves putting an actual physical barrier in position to block sound waves. The simplest is a pair of earplugs, and there are many choices. Full cup headsets, which came into use long after the invention of the airplane, can reduce sound even further. It is important, moreover, to evaluate the plane for ‘sound proofing’ materials, since many acoustic devices can reduce engine noise through insulating blankets in the cabin side panels, the head liner, and improved door seals. Unfortunately, most headsets provide more protection in the upper ranges of the frequency spectrum than the lower levels, where the most damaging noise is heard.

Active attenuation is a product of the computer age. This works by using a small microphone in the pilot’s headset, sensing the frequency of the loudest and potentially damaging sound. A processor then generates an opposite phase signal of the same noise amplitude. This new sound is sent to a speaker in the ear cup, thus canceling the first sound. The result is a substantial reduction or elimination of the noise. Similar systems for active noise control are available today for certain jet and turboprop aircraft cabins, using technology similar to the ANR headsets. For turbine aircraft, there is no better hearing protection solution available today for passengers or the crew.

The purpose of this hearing review is to make each of us as pilots more aware of our daily exposure to noise, especially the louder damaging variety. And, at home the table saws, chain saws, kitchen blenders, air compressors, lawn mowers, weed-eaters, and even vacuum sweepers all contribute to the threat to our hearing. Giving thought to this irreplaceable gift pays dividends, at home as well as the airport. It is possible to preserve much more of this precious division of our five senses. Get the best headset you can afford for your airplane, and take care of your passenger’s hearing, too. Then, you can smile and respond when your kids say, “Grandpa, thanks for that neat plane ride.”

[Doctor Hansen, author of the popular book on home health care, ***Get Well At Home****, currently serves as medical director of the* ***Emerald Valley Wellness Clinic****, and its* ***Live-for-Health Seminars*** *in Creswell, Oregon. Pilots who for health reason are having trouble passing their medical should contact us.]*