A Breath of Fresh Air

by Don Abbott

I live in Florida, a state where the highest elevation is 345 feet above sea level. My F33A Bonanza is based at KFMY, elevation 17.1 feet. When I have travelled to locations with a much higher altitude, such as Denver, Colorado (5,367 feet); Sedona, Arizona (4,341 feet); or Taos, New Mexico (6,969 feet), low body oxygen levels have caused mild symptoms of altitude sickness. More serious symptoms, like mental confusion, trouble walking, and shortness of breath, can happen at higher elevations such as those found in Leadville, Colorado (10,152 MSL). Over the years, I began to ask myself, "Doesn't it stand to reason that low oxygen levels could also affect my ability as a pilot?"

Read on

There have been many articles written about the use of supplemental oxygen in airplanes. If you, like me, have nonchalantly cast them aside, maybe it is time for a lifesaving re-read. Here are some facts about the effects of the "Grim Deceiver" called hypoxia.

Oxygen starvation, or hypoxia, can occur as low as 5,000 feet and brings with it decreased night vision. At 8,000 feet forced concentration, fatigue and headache may occur, and a pilot's ability to make quick, rational decisions becomes more difficult. Some pilot victims of hypoxia have become belligerent, even declaring, "The last thing in the world I need is oxygen. After all, I am doing a much better job of flying than I have ever done before!" Caution: Do not open that door!

In 2004 I bought a dream 1965 Beechcraft Debonair (featured on the cover of the August 2004 *ABS Magazine*). Shortly after I took possession, a good friend and fellow pilot, Frank Thomas, sent a gift of a four-place portable oxygen system along with a note extolling the attributes of in-flight oxygen. I stored the system in the baggage compartment and only used it occasionally on long trips. There never seemed to be a "right place" in the cabin for the tank, all the tubes, cannulas, masks, valves, meters, and knobs. The mere mention to my passengers that "we may need oxygen" prompted a lot of fear in the ranks. As a result, for many years I considered the use of supplemental oxygen as pretty much a non-essential bother. As a more seasoned (okay, older) pilot, I have since changed my mind... dramatically.

According to the FAA Aviation Regulations: "No person may operate a civil aircraft of U.S. registry at cabin pressure altitudes above 12,500 feet (MSL) unless the required minimum flight crew is provided with and uses supplemental oxygen for that part of the flight at those altitudes that is more than 30 minutes duration."

Common sense dictates the more prudent use of oxygen. Pilots who are older, heavier, out of condition, or smoke, should limit their flying above 8,000 feet unless oxygen is available. At sea level, a one pack a day smoker may experience the symptoms of hypoxia at an altitude of 7,000 feet. At 10,000 feet that could equate to an altitude of 17,000 feet! Definitely time to don the mask.

A person's age drastically affects night vision. A 60-year-old has only one-third of the night vision of a 20-year-old. In addition, there is very little peripheral vision at night and colors are less vivid. Some medical professionals promote the use of oxygen on all night flights above 5,000 feet at any age. For the best night vision protection, many suggest the use of oxygen from the ground up. Medical sources tell us that women normally need oxygen about 2,000 feet lower than men. For some women, sleepiness and headaches can occur around 9,000 to 10,000 feet. When one is nervous the body is working harder, thus a nervous passenger (male or female) needs more oxygen. First-time flyers and even experienced pilots flying instrument approaches will benefit greatly from the use of supplemental oxygen.

While turbocharged piston aircraft are generally delivered with built-in factory oxygen systems, most normally aspirated models are not. For those of us flying below the flight levels, here are some ideas and tips for enjoying the advantage of on-board oxygen.

A pulse oximeter in every flight bag

A pulse oximeter (**Figure 1**) is a small device that allows crewmembers and passengers to determine the need for supplemental oxygen at various altitudes. Although there are no official recommendations for the use of a pulse oximeter, here are some basic suggestions:

Before a flight, use the pulse oximeter on the ground to determine your normal oxygen saturation at your home elevation. Readings at sea level will be 95 to 100 percent. Write down your normal level.

Note: Normal readings will vary depending on ground elevation. For example, at 10,000 feet "normal" is 88 to 93 percent.

Figure 1

When leveling off at altitude, take another reading. If the oxygen saturation level drops five percent below your personal normal you will feel better, and experience less fatigue, by using supplemental oxygen. If the saturation level drops 10 percent, using supplemental oxygen is not an option. It is *required*—by good sense, if not by regulation.

There are several pulse oximeters on the market, with a wide range of prices. The most sophisticated is by Guardian Aero. It offers a panel-mount unit with a RS232 interface to a Multi-Function Display (MFD) for $999. Hold the panic attack. The good news is the same oxygen level technology is available at Walgreens or CVS for about $40. Amazon advertises pulse oximeters as low as $9.

Choosing the right oxygen system

Permanent oxygen systems involve a great deal of labor, and most require FAA field approval for certified aircraft. Here, we will review the two types of *portable* oxygen systems available: Constant Flow and Demand. Both types in one-, two-, and four-place versions are marketed by Precise Flight and Mountain High.

Go with the flow

Constant flow systems incorporate an in-line flow meter that is manually adjusted for the altitude at which you are flying (**Figure 2**). The flow meter must be readjusted with changes in altitude. Non-pilots are generally not comfortable using the flow meter, in my experience. These systems include an oxygen tank, regulator, flow meters, masks, cannulas, carrying cases, and seatback mounting straps. Two-place systems are priced from around $800 to $1,100 depending on the size of the oxygen storage tank. Four-place systems are available for around $1,300.

On demand

Unlike constant flow systems that deliver more oxygen than the body needs, pulse-demand systems provide oxygen only when you inhale. In addition, oxygen demand is automatically adjusted according to pressure altitude. The difference between the Precise Flight OXYpack and the Mountain High EDS Pulse-Demand System is the control unit. Precise Flight's X3 Demand Conserver is mechanical while Mountain High relies

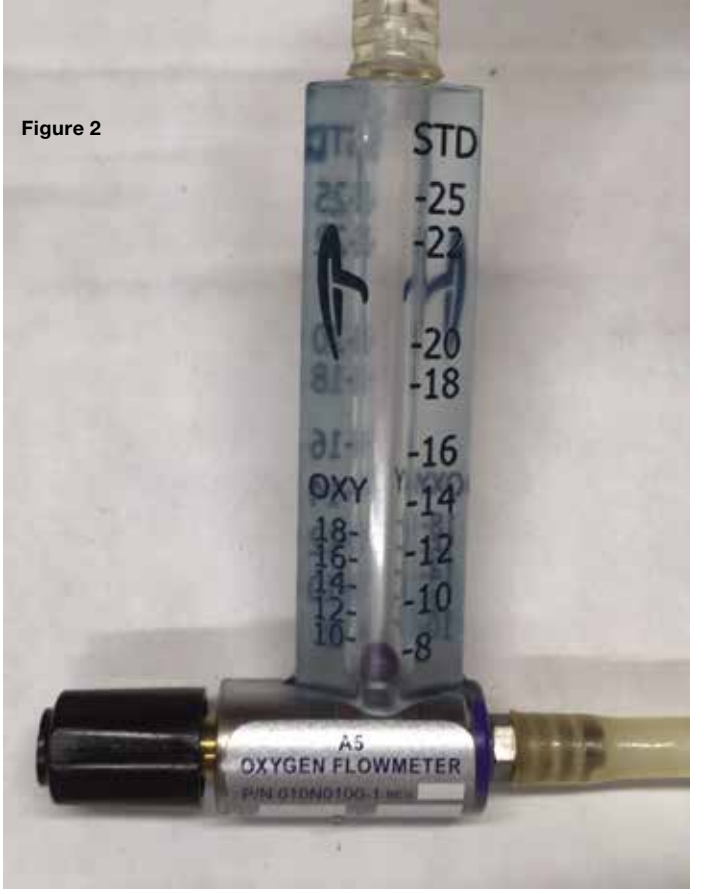

Figure 2

Figure 3

on battery or USB power. As you breathe in, the PF X3 supplies a constant flow of oxygen. The MH O2D2 fires a short blast of oxygen, making a sound as it does. The Mountain High system also monitors functions and alerts by an LED display and sound that can be wired to the aircraft audio panel. A multi-position switch (**fFgure 3**) allows you to select:

1. Activation at all altitudes;
2. Activation at or above 5,000 or 10,000 feet pressure altitude; or
3. Several stages of increased flow percentage when using a face mask or when more oxygen is required.

Precise Flight offers the OXYpack Endurance Series for two people with a 22-cubic-foot oxygen cylinder with regulator, two X3 Demand Conservers, two dual lumen cannulas, and two dual lumen masks all in a case with a seatback harness. The price is advertised at $2,749. I could not find a four-place system on the Precise Flight website, but I'm sure a phone call would answer the question.

Figure 4

Figure 5

Figure 6

Mountain High EDS Pulse-Demand systems range from $1,165 to $3,540 depending on capacity of the oxygen cylinder, type of regulator, number of pulse-demand units, standard cannulas, and masks. A case and harness are included. If you already have a cylinder and a MH approved regulator, the single place O2D1 is priced at $695. The two-place O2D2 is $895. A four- or six-place system requires additional Pulse-Demand control units.

For my F33A Bonanza (ABS cover August 2010), I wanted a four-place compact system that rivals the features of a built-in. I chose the Mountain High system with two 02D2 control units, 22.5-cubic-foot cylinder, and four-port regulator. I secured the cylinder aft and under the right rear seat using three-quarter inch, quick release straps through the tie-down brackets in the aircraft (**Figure 4**). The baggage door provides easy access to the shutoff valve and oxygen level meter and allows for quick cylinder removal for a refill. The Pulse-Demand control units are secured to the left forward and aft sidewalls with heavy duty Velcro (**Figures 5** and **6**).

Mountain High was my pick for many reasons including price. In addition, I like the function switch, LED and audio alerts, mounting flexibility, and choice of battery or USB power. Because I can fly longer between O^2 refills with the Pulse-Demand system, I can depend on oxygen more frequently. That means fewer headaches, less fatigue on long flights, and increased alertness at night and during approaches.

If you have been on the fence about using supplemental oxygen, I strongly suggest you decide in favor of doing so. You can try it without a big investment. Many suppliers including Precise, Mountain High, Aerox, Skyox, and Delta offer entry level systems, some as low as $450. Once you begin to realize the many benefits of using supplemental oxygen, it will not take long to conclude... there is nothing like a breath of fresh air.

Don Abbott flies an F33A. He has been a member of ABS since 2000.